Report

Analysis of Historic Water Level Data Related to Proposed Assured Water Supply Physical Availability Criteria for the Santa Cruz Active Management Area

Santa Cruz and Pima Counties, Arizona

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Background and Purpose

Proposed new groundwater withdrawals for Assured Water Supply (AWS) purposes in the Santa Cruz Active Management Area (AMA) or SCAMA must be consistent with the AMA's dual water management goals of maintaining safe yield and preventing local water tables from experiencing long-term declines (A.R.S. 45-562.C). Over the last several years the ADWR and interested stakeholders have held numerous meetings to develop concepts for AWS rules that provide an analytical framework to interpret and implement the AMA's unique water management goals. From those discussions it has been generally recognized that the evaluation of consistency with the goal criteria for assured water supply purposes, should be based in part on a comparison of projected groundwater levels to historic water levels at specific wells in the area of projected hydrologic impact of a proposed new development. Further, it has been generally recognized that the evaluation of the physical availability criteria for assured water supply purposes should also use this same method of comparison of projected water levels at specific wells in the area of projected hydrologic impact.

The proposed Santa Cruz AMA AWS rules require new well water withdrawals in support of AWS determinations to be consistent with the AMA physical availability requirements, as well as be consistent with the goal of the AMA. Consistency with AMA physical availability and goal requirements will be demonstrated only if hydrologic studies indicate that the new withdrawals will not cause the projected depth-to-static water level to decline at water level monitoring locations by no more than one standard deviation below the average historic depth-to-static water level (the "target" water level) for more than 10 percent of the months in a series of 100-year AWS model simulations. Additionally, the proposed rules do not allow the projected depth-to-static water level to exceed more than one standard deviation below the historic average depth-to-static water level for more than 12 consecutive months in any one (or single) model simulation.

The following report presents an analysis of available groundwater level data for the Santa Cruz AMA. Factors effecting the calculation of average historic groundwater levels, such as the availability of historical water level data and the differences in the periods of record for wells are discussed. The analysis includes the calculation of average historic water levels and standard deviations for selected wells that will be used to evaluate the potential impacts of proposed new AWS withdrawals. The report concludes with an analysis that shows how historic groundwater levels compare to the proposed "target" water levels.

Historical groundwater level data in the Santa Cruz AMA

Historical groundwater level measurement data for the Santa Cruz AMA cover the period from 1934 to 2007. These data are recorded in the ADWR Groundwater Site Inventory (GWSI) database. Data from 2007 were not included in this study because the proposed AWS rules require the historical average depth-to-static water level to be determined for any given well from all available measurements made before 2007 (1934 – 2006). The GWSI database lists 6,273 individual depth-to-water measurements taken at a total of 548 wells located in the Santa Cruz AMA for the period from May, 1934 through Dec, 2006.

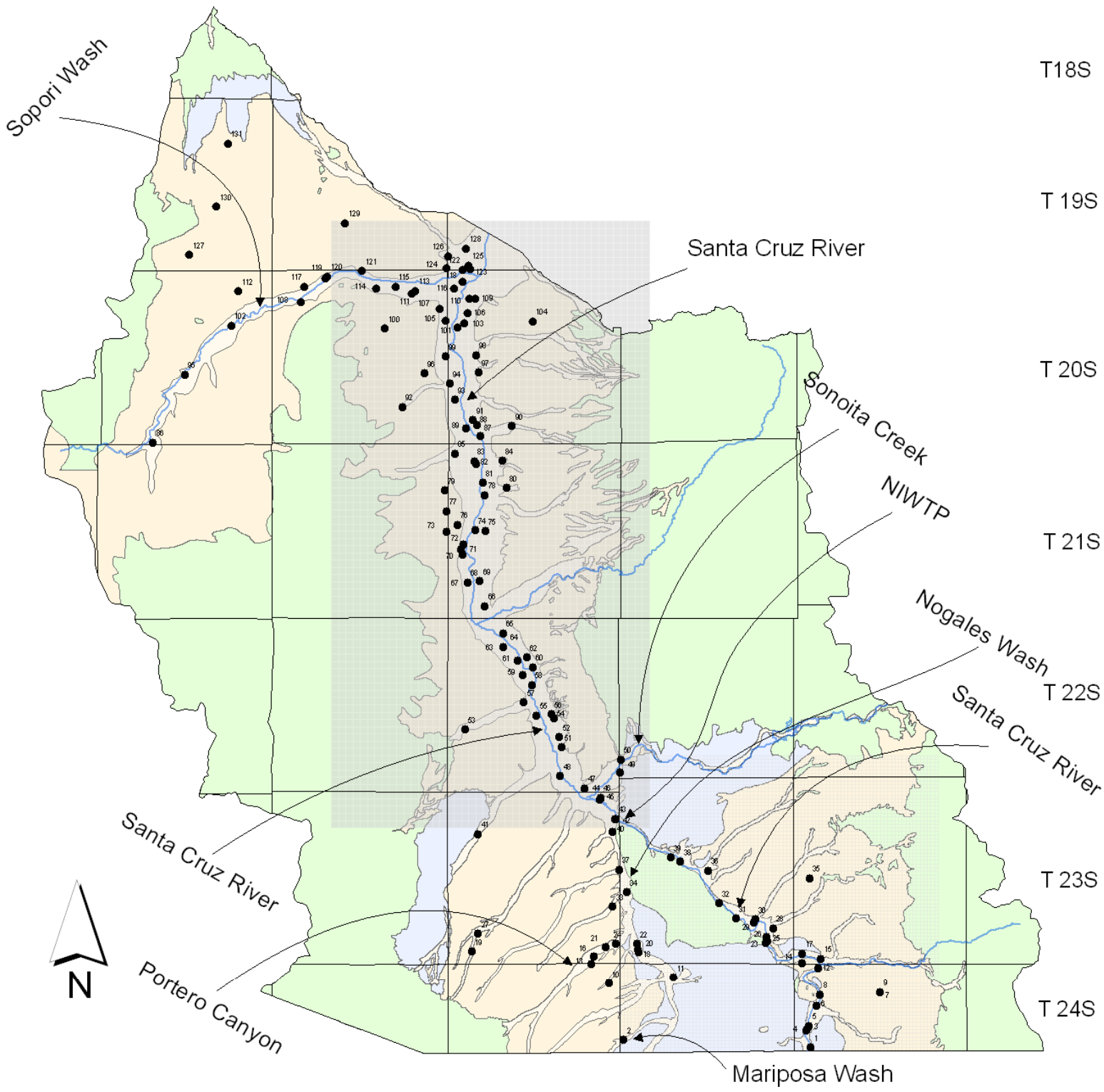
For the purposes of this analysis, historic depth-to-static water level measurement data were evaluated for all wells in the Santa Cruz AMA that had at least ten depth-to-water level measurements made prior to 2007. A total of 131 wells met this requirement. The wells that were selected for analysis are listed in Table 1, with the locations shown on Figure 1. Measurements annotated with remarks indicating non-static water level conditions, such as measurements that were influenced by on-going or nearby pumping were discounted for this analysis.

The total number of water level measurements that were made for all wells in the AMA is summarized by decade in Figure 2. Figure 2 shows that approximately 1,000 individual water level measurements were made during each of the periods: 1940-1949, 1950-1959, 1960-1969, 1990-1999 and 2000-2006. Less than 500 individual measurements were made during each of the periods: 1970-1979 and 1980-1989.

The monthly distribution of water level measurement data is shown for the period 1934 to 2006 in Figure 3. The data indicate that the majority of measurements were made in the fall and winter months (October-March). The overall monthly distribution of water level data for the period 1934 to 2006 indicates a predominance of fall and winter measurements. However, a review of the monthly distributions of measurements, by decade, reveals that the distribution of monthly measurements was more uniform during the 1940's and 1950's than for other periods (see Appendix A).

The depth-to-static water level measurements that were analyzed for each well listed in Table 1 were summarized using the following statistics: the count (number of measurements analyzed), a "weighted" historical average or mean depth-to-static water level (dtw), the median dtw, the minimum dtw, the maximum dtw, and one and two-standard deviations from the weighted average dtw.

FIGURE 1
SCAMA - Well Locations



Legend

- Well # (from table)
- Streams
- Township / Range
- Basin
- North SCAMA Model
- SCAMA Microbasin Model

SCAMA Geology

TYPE

- Younger Alluvium
- Older Alluvium
- Nogales Formation
- Unidentified Bedrock

0 2 4 8 12 Miles

ARIZONA DEPARTMENT OF WATER RESOURCES

Figure 1: Santa Cruz AMA - Well Locations

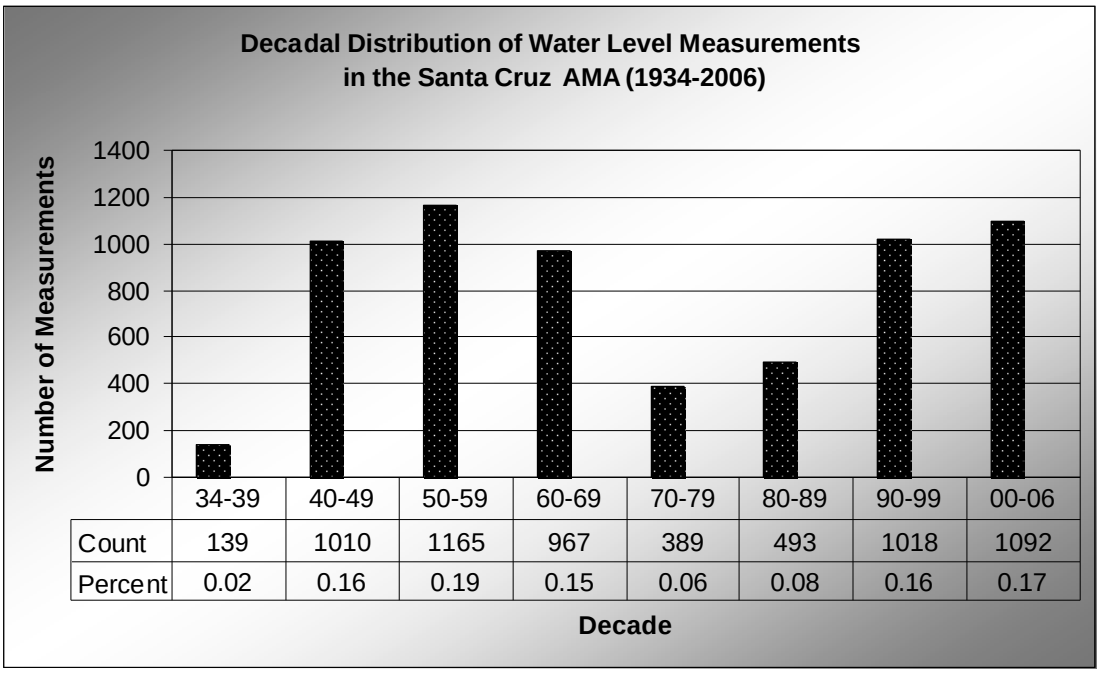


Figure 2: Decadal Distribution of Water Level Measurements in the Santa Cruz AMA (1934-2006)

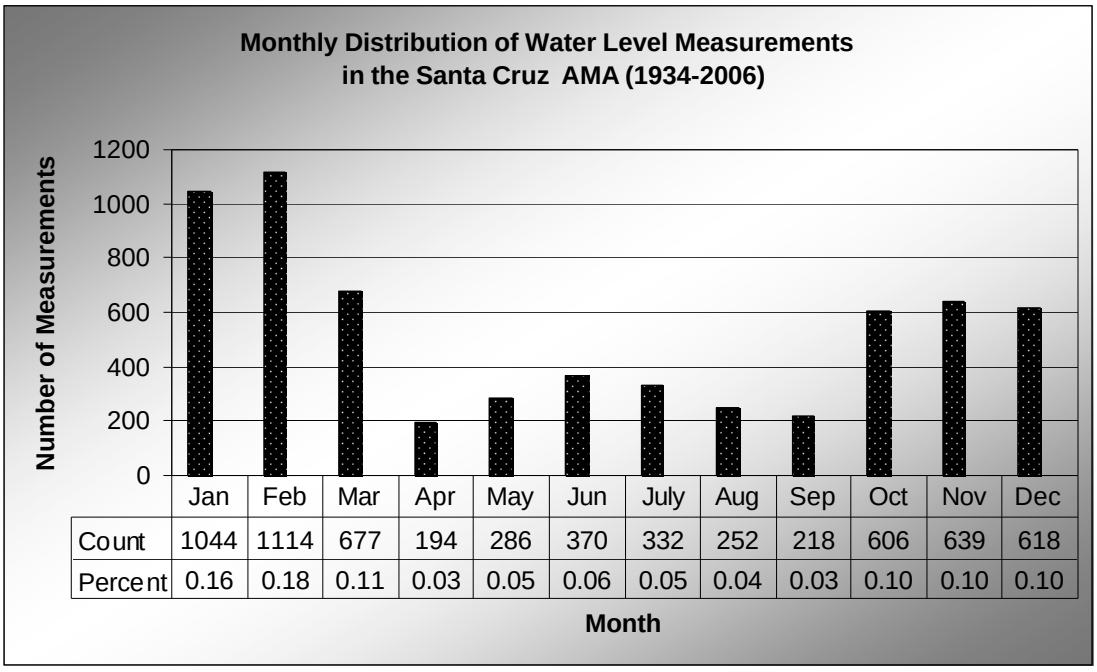


Figure 3: Monthly Distributions of Water Level Measurements in the Santa Cruz AMA (1934-2006)

A "weighted" historical average dtw was calculated for each well to account for the large variability in water level measurement frequencies and water level data availability between different wells. A detailed discussion of the weighting methodology is presented in the next section of this report. The statistical analysis of historical depth-to-water data is summarized in Table 1. The weighted average dtw per well, for the period of record of the well, is shown in Figure 4. One and two-standard deviations from the weighted historical average dtw for the period of record of each well are shown in Figures 5 and 6, respectively.

Factors that effect historic "average" water level calculations

The statistical analysis of water level data in the Santa Cruz AMA consists of the calculation of the average historic depth-to-static water level and the standard deviation from the average historic depth-to-static water level at various groundwater monitoring locations (wells) throughout the AMA. While these statistics are customarily calculated for many types of hydrologic datasets, it is important to recognize that the historic water level measurements in the Santa Cruz AMA were not made on a uniform or random basis, and the set of measurements is not necessarily normally distributed.

The monthly and annual distributions of water level measurements are variable both by well, and for the entire set of wells taken as a whole. One of the major consequences of the variability in measurement distributions is that the period of record over which the average depth-to-static water level was calculated varies for each well. So, in some cases, a well's average historic depth-to-static water level may have been calculated over a relatively short period of time that is non-representative of long-term hydrologic conditions. The significance of this fact is that the average "historic" depths-to-water that have been calculated do not necessarily represent the actual long-term average historic depth-to-static water level. However, it seems likely that the actual long-term average historic depth-to-static water level falls between the extremes of the measurements that have been made for most wells that have reasonably long periods of record. The following section discusses some of the more important factors that effect the average historic depth-to-static water level calculations.

As mentioned previously, the variation in the frequency of water level measurements per well influences the calculation of the average "historic" depth-to-static water level. Figure 2 shows that the overall availability of water level data varies substantially by decade, particularly during the 1970's and 1980's when far fewer measurements were made than at other times. The "numeric" impact of this situation can be seen in the hydrograph for well D-22-13 35DCD (Figure 7). Inspection of Figure 7 reveals that numerous measurements were made during the period from 1940 to about 1955, and far fewer measurements were made after that time. Although the hydrograph for the well conveys a reasonable visual impression of average water level conditions in the aquifer, the non-uniformity in measurement frequency strongly biases the calculated arithmetic average if all the measurements are used in the analysis.

FIGURE 4
SCAMA - Mean DTW (ft) for Period of Record of Plotted Wells

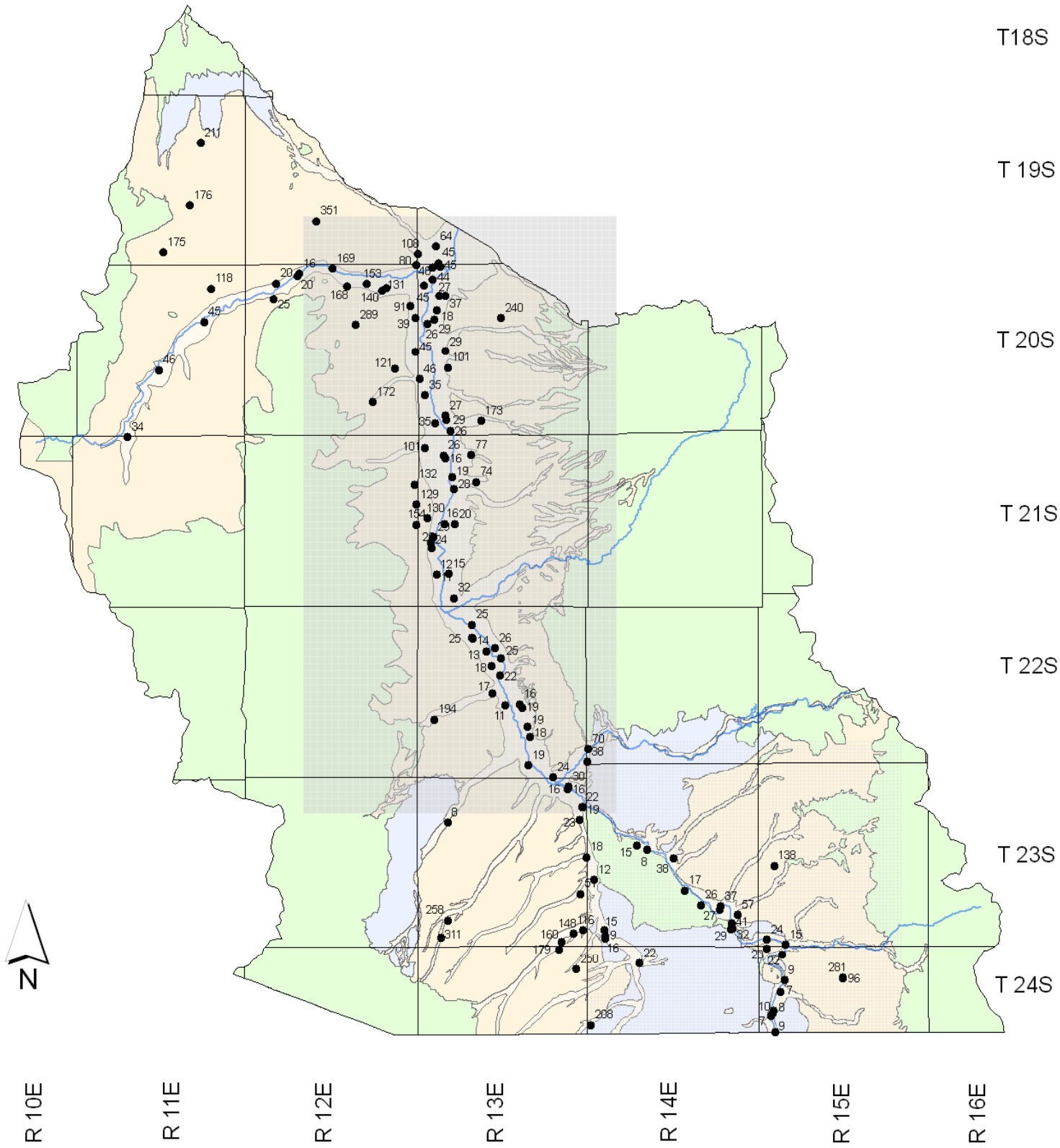


Figure 4: Santa Cruz AMA – Mean DTW (ft) for Period of Record of Plotted Wells

FIGURE 5
SCAMA - One Standard Deviation (ft) From the Average Depth to Water of Plotted Wells

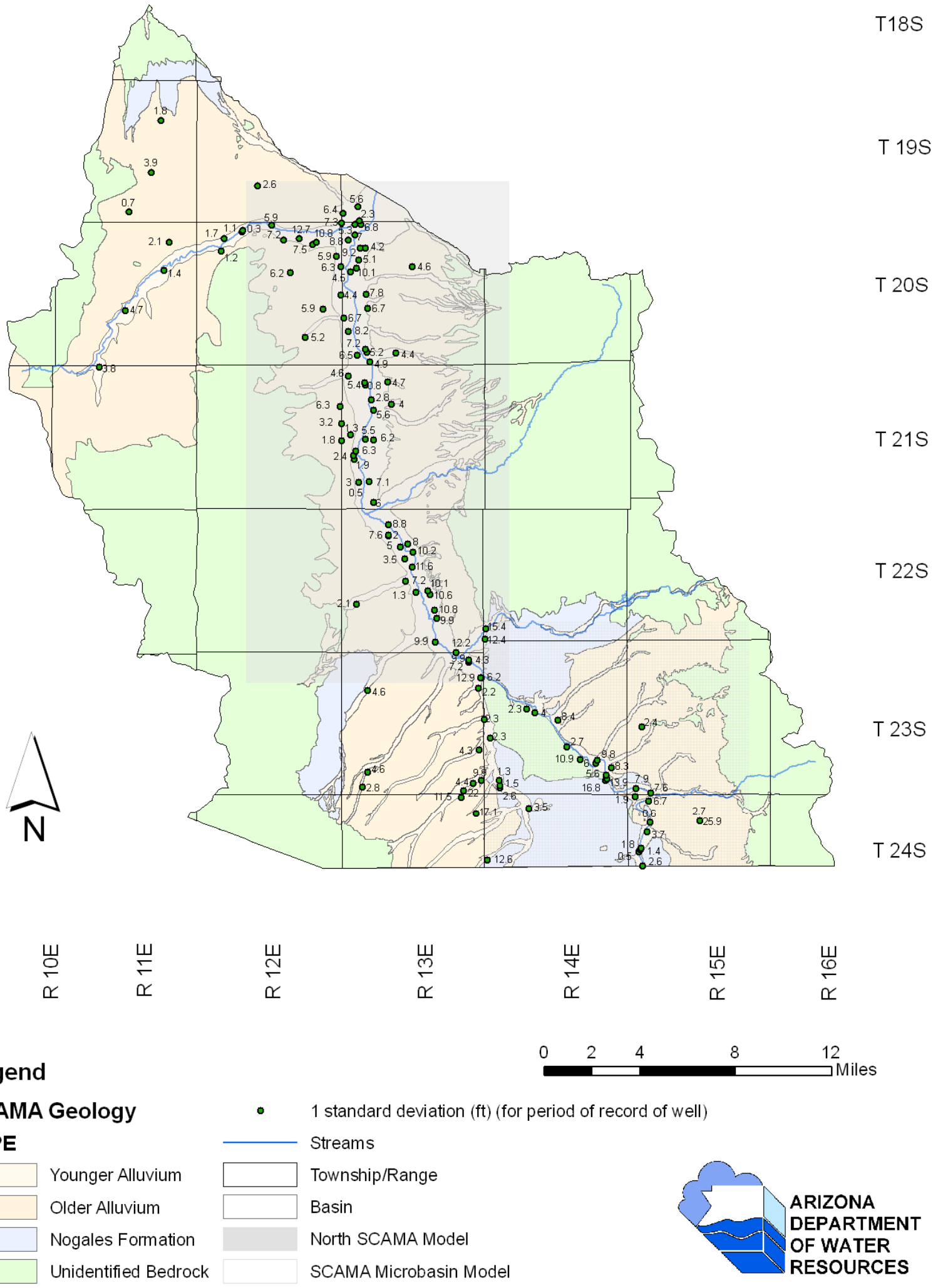


Figure 5: Santa Cruz AMA – One Standard Deviation (ft) from the Average Depth to Water of Plotted Wells

FIGURE 6
SCAMA - Two Standard Deviation (ft) From the Average Depth to Water of Plotted Wells

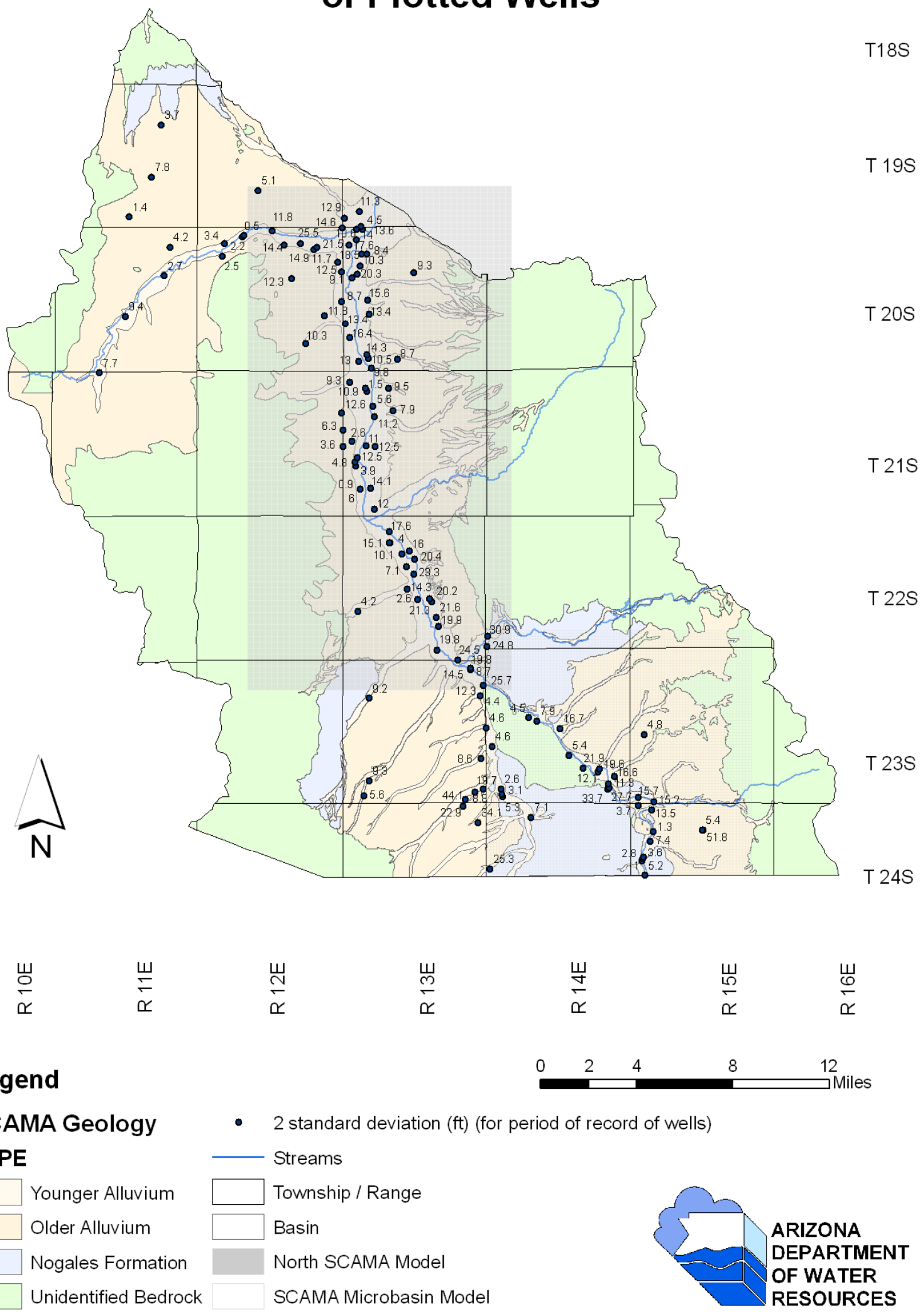


Figure 6: Santa Cruz AMA – Two Standard Deviation (ft) from the Average Depth to Water of Plotted Wells

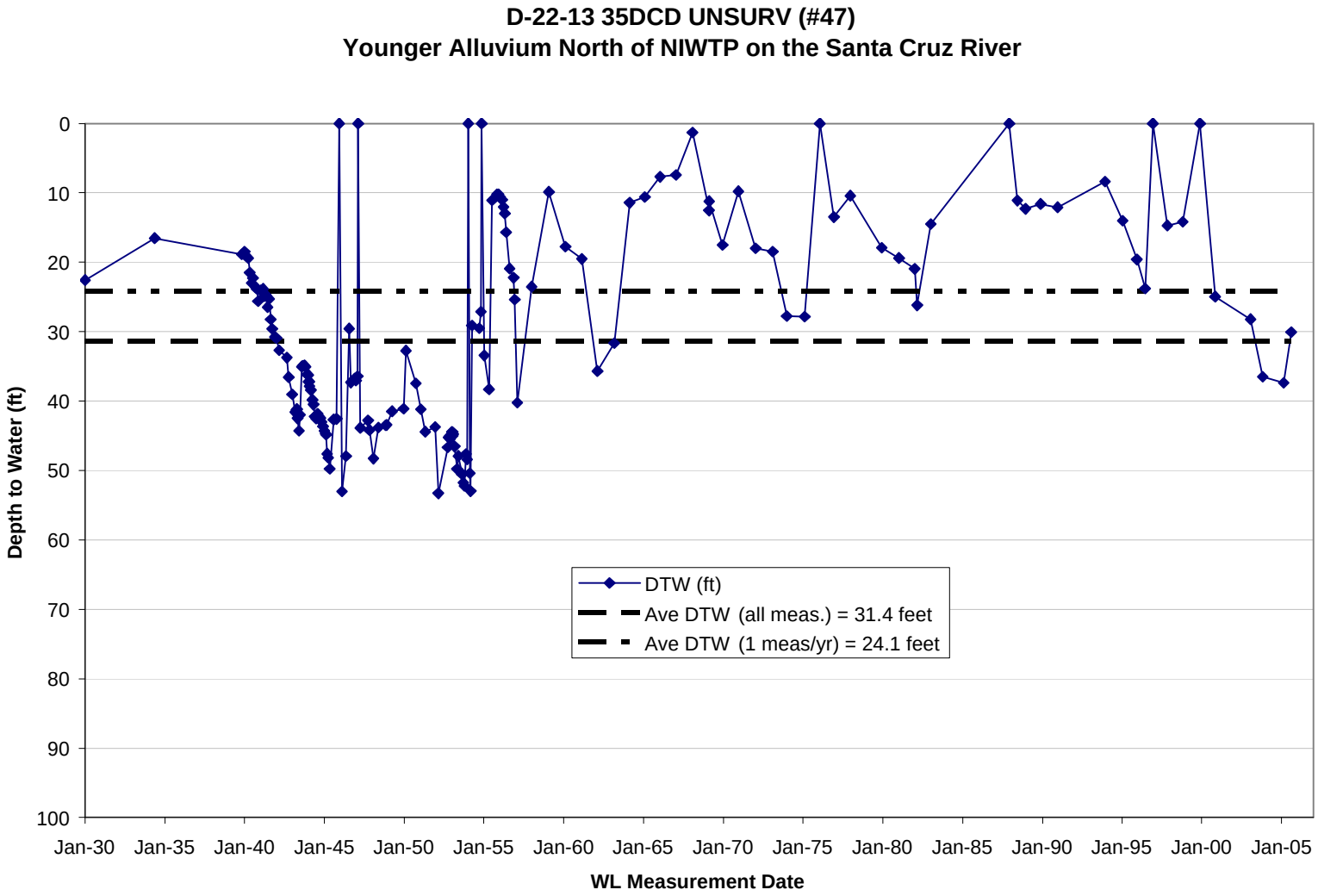


Figure 7: Hydrograph for Well D-22-13 35DCD

In order to examine the numeric impact of the non-uniform distribution of data, two different depth-to-water averages were calculated. The first average (the arithmetic average), of 31.4 feet, was calculated using all the available depth-to-water level measurements for the well. It should be noted that the arithmetic average assigns equal "weight" to each depth-to-water measurement. Therefore, the arithmetic average will be influenced (biased) more strongly for years when multiple depth-to-water measurements were made.

To reduce the potential statistical bias associated with the arithmetic mean, a second "weighted" average was calculated. The weighted average was calculated by averaging the dtw measurements for individual years when multiple water level measurements were made. Using this approach a single "average" depth-to-water value was calculated for each year that had multiple dtw measurements. The "average" dtw values for individual years with multiple measurements were then averaged with individual dtw measurements for other years that had only one measurement per year. The resulting weighted average dtw for the well was 24.1 feet. The results of this analysis show that the arithmetic average can be highly biased for some wells that have particularly non-uniform temporal distributions of measurement data. Based on these results the weighted historical average depth-to-water will be used for future analysis and evaluation of consistency with AWS physical availability criterion.

Analyses of the available data indicate that the monthly distribution of measurements has some impact on calculated "historic" averages. For example, the average static water level was calculated for each well listed in Table 1 that had water level measurements made during the 1940s. The 1940's were chosen for this test because most of the wells measured during the 1940's and early to mid-1950's had monthly measurement frequencies. For each well, two averages were calculated. One average was based only on measurements made during the fall and winter months from October through March, which is more representative of more recent measurement schedules. The second average was calculated using all measurements taken. The results showed that the calculated average historic depth-to-static water level during the 1940's was about .5 foot shallower per well when only the fall and winter measurements were used to calculate the average. This result is consistent with the fact that groundwater levels generally tend to be deeper in the spring and summer months when groundwater demands from pumping and riparian vegetation are greater than other times of the year, except perhaps after flood events that may recharge the Younger Alluvial (YAL) aquifer.

Flood flows on the Santa Cruz River often cause significant impacts to groundwater levels in the YAL aquifer. This is particularly true along the Microbasin reach of the river between the Mexico-US International Border and the Nogales International Wastewater Treatment Plant. Infiltration of surface flow in each microbasin can occur rapidly if aquifer storage is available (Erwin, 2007). Figure 8 shows the aquifer's response to a storm event in October 2004. Ideally, the temporal distribution of historic water level measurement data should be uniform and frequent enough to observe the impacts of any significant flood events on groundwater levels. Unfortunately, the actual

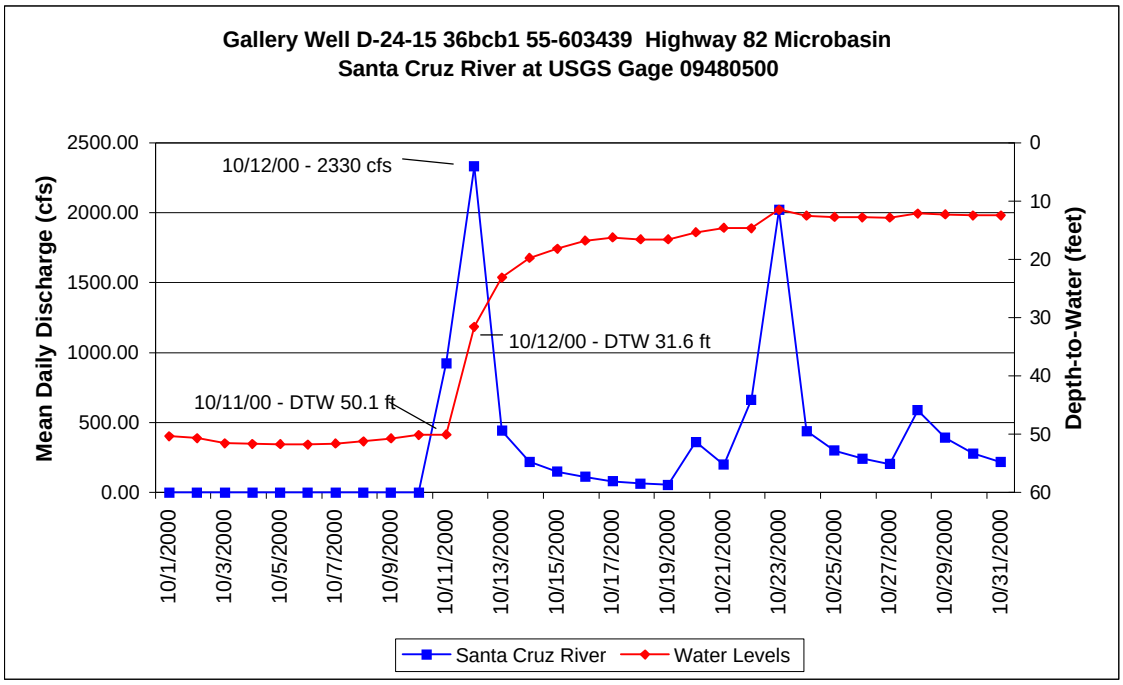


Figure 8: Hydrograph Showing Water Level Response to Santa Cruz River Flow in the Highway 82 Microbasin

distribution of historic water level measurement data in the AMA is far from being uniform or plentiful (Figures 2 and 3). Comparisons of regularly scheduled "index" well measurements to continuously recorded pressure transducer data indicate that many actual groundwater "peaks" and "valleys" may be missed by annual measurements (Nelson, 2007b). For example, continuous recording water level pressure transducer data for well D(21-13) 5ccb, located in the YAL of the Santa Cruz River near Tubac indicate that the water level in the well spiked by about 5 feet after the October/November 2000 flood event. However, the non-automated quarterly water level measurements for that well did not show any significant rise in water level. This situation probably has influenced the average historic depth-to-static water level that has been calculated for other wells if few water level measurements were made during historic periods of high or low annual flow (Figure 9).

The previous example showed the short-term impacts of a major flood event on groundwater levels in the Highway 82 Microbasin. While the example illustrates the fact that periodic flood events can provide recharge that temporarily cause groundwater levels to rise, a review of long-term hydrograph data shows a basic trend seen in many wells along the Santa Cruz River toward shallower water levels since about the mid-1950's (see Figure 7, and other hydrographs in Appendix B). This trend correlates with several factors that include: several years of above average stream flow on the Santa Cruz River (Figure 9), reductions in agricultural water use, and the introduction of effluent in the

early 1970's. It should also be noted that the hydrograph for well D 23-13 35DCD (Figure 7) shows a general decline in water levels from the late 1990's to 2005. This decline is believed to be related, in part, to the persistent drought that has caused significant reductions in surface water runoff for most of the last 10 years (Figure 9).

The point to consider from these examples is that "average" local water table conditions have changed appreciably since the 1940's along much of the reach of the Santa Cruz River in the AMA, particularly downstream of the Nogales International Wastewater Treatment (NIWTP). Therefore, the "average" annual hydrologic conditions that are seen as the norm of today are not necessarily representative of earlier times, or of future times.

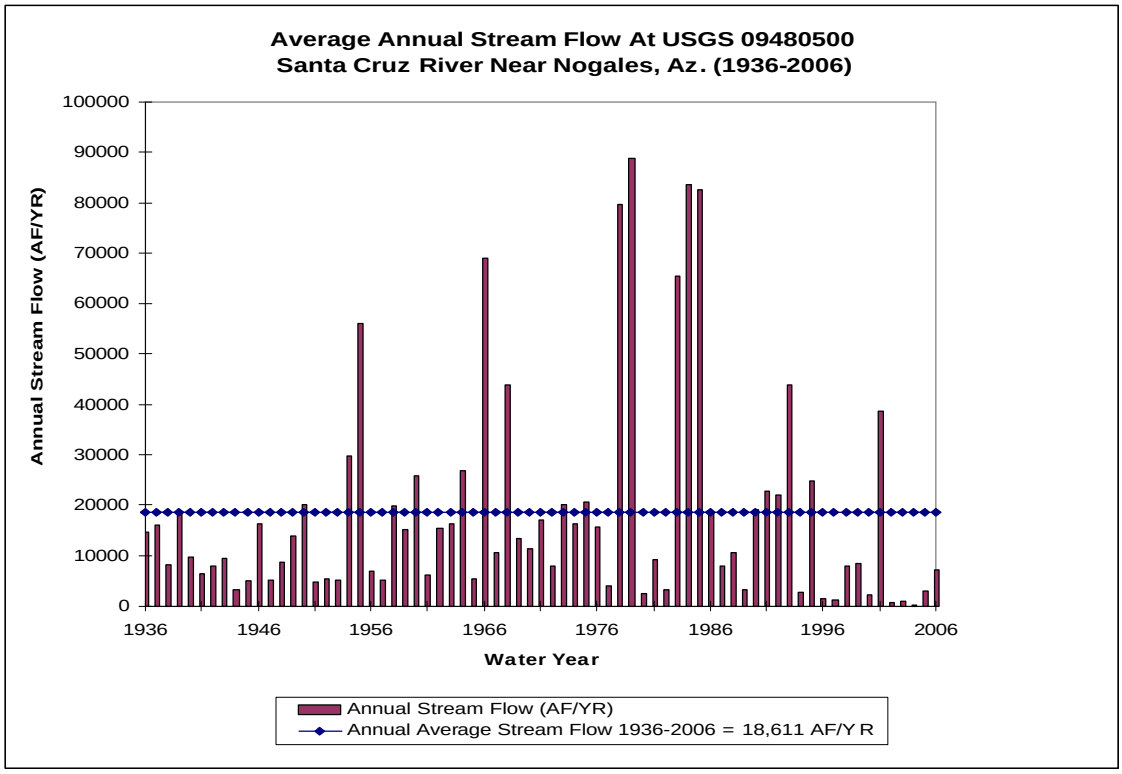


Figure 9: Average Annual Stream Flow At USGS 09480500 Santa Cruz River Near Nogales, AZ (1936-2006)

Effluent discharge to the Santa Cruz River has created an additional source of recharge since 1972 (Nelson, 2007A). The discharge of treated effluent into the channel of the Santa Cruz River downstream from the NIWTP has contributed to the overall rise in groundwater levels north of the plant since the early 1970's. This trend can be seen in many of the hydrographs shown in Appendix B.

The impact of effluent discharge on calculated average historic groundwater levels was analyzed by calculating two different historical averages for each well that had been measured during both the pre-effluent (pre-1972) and post-effluent periods. The first average was calculated for each well based only on pre-1972 water level measurements. The second average was calculated for each well based on all available measurements made over the period of record of the well. Results were analyzed for wells located in the YAL of the Santa Cruz River, both upstream (11 wells) and downstream (30 wells) of the NIWTP. The analysis showed that the calculated "pre-effluent" average historic depth-to-static water level was about 2.5 feet deeper per well than the average that was calculated using all available measurements for wells located downstream of the NIWTP. The calculated "pre-effluent" average depth-to-static water level was about 1.1 foot shallower per well than the average that was calculated based on all available measurements for wells located upstream of the NITWP.

The proposed "target" water level concept

The proposed AWS rules for the Santa Cruz AMA require an analysis of projected water levels compared to historic water levels at groundwater monitoring locations in the area of projected hydrologic impact of a proposed new development. The proposed AWS criterion are based on the Department's analysis and on recommendations made by the Santa Cruz AMA GUAC sub-committee on AWS rules development. The proposed AWS criterion require a statistical analysis of historic water level data to determine the average historic depth-to-static water level and the standard deviation from the average historic depth-to-static water level at groundwater monitoring sites throughout the AMA. This section presents an example of how the target water level "threshold" is calculated for an individual well, and how exceedances of target level thresholds are calculated.

For this example, lines indicating the average historic depth-to-static water level (24.5 feet) and one-standard deviation (10.2 feet) below the average historic depth-to-static water level for well D-22-13 09DA2 are shown on the well's hydrograph (Figure 10). The "target" threshold depth for this well is then calculated by adding one standard deviation (10.2 feet) to the average historic depth-to-static water level (24.5 feet), which is equal to 34.7 feet. Examination of the historic depth-to-water measurements for this well indicates that the 34.7 foot, one-standard deviation "target" threshold was exceeded 12 times during the historical period of record for the well (Table 1).

For any given well, the proposed AWS rules do not allow the projected future water level to drop below the target threshold depth for more than 10 percent of the months in a series of 100-year model simulations. An exceedance is counted for each month in a series of model simulations when the projected depth-to-water drops below the target threshold depth.

For projected model simulations that consist of a series of 100 separate, 100-year model simulations (or a total of 120,000 individual months in the series of simulations), the

projected depth-to-water cannot exceed 34.7 feet below land surface for more than 12,000 months in the model cell where the well, D-22-13 09DA2, is located.

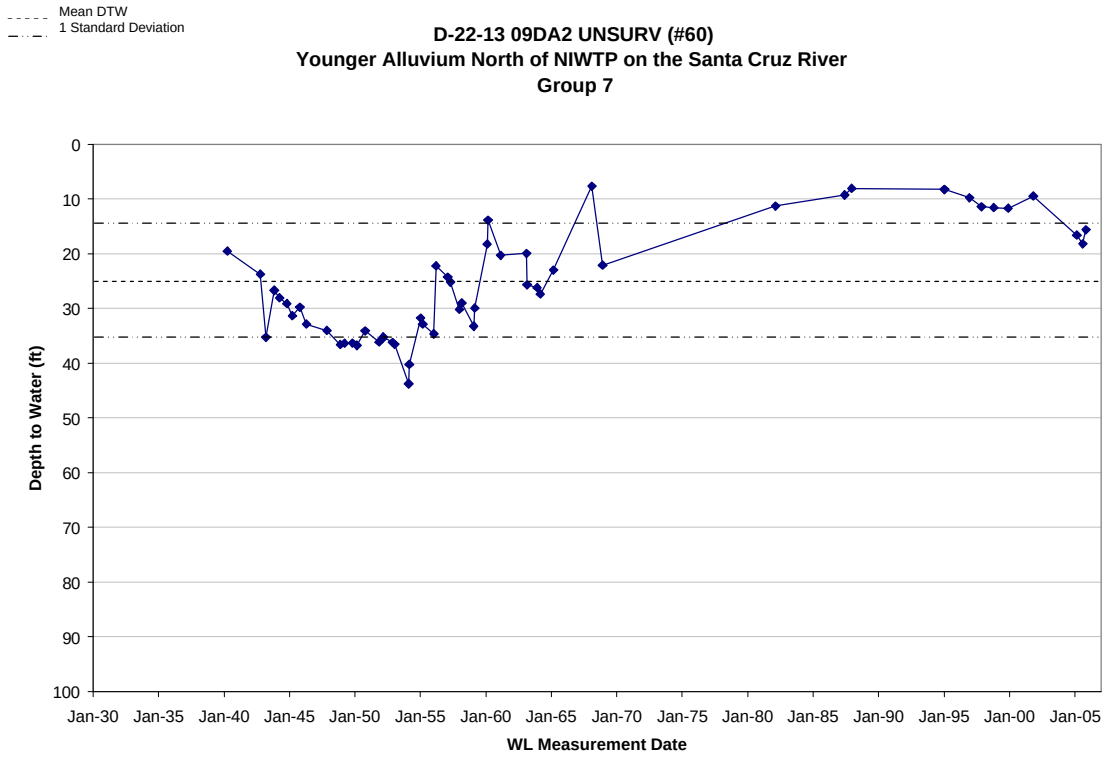


Figure 10: Hydrograph for Well D-22-13 09DA2 Showing Average and 1-Standard Deviation "Target" Threshold Depths

Comparison of historic water level data to proposed "target" water levels

A tally of historical depths-to-water which exceeded the one-standard deviation target threshold depth is listed for each well in Table 1. This analysis was performed to determine how historic water levels compared to the proposed target threshold depths. The number of one-standard deviation exceedances per well are shown in Figure 11. The number of one-standard deviation exceedances per decade is shown in Figure 12. The data show that the greatest number of exceedances occurred during the 40's and 50's and more recently during the period from 2000-2006. The temporal distribution of historical

FIGURE 11
SCAMA - Number of Exceedances for Plotted Wells Using a One Standard Deviation Target Threshold

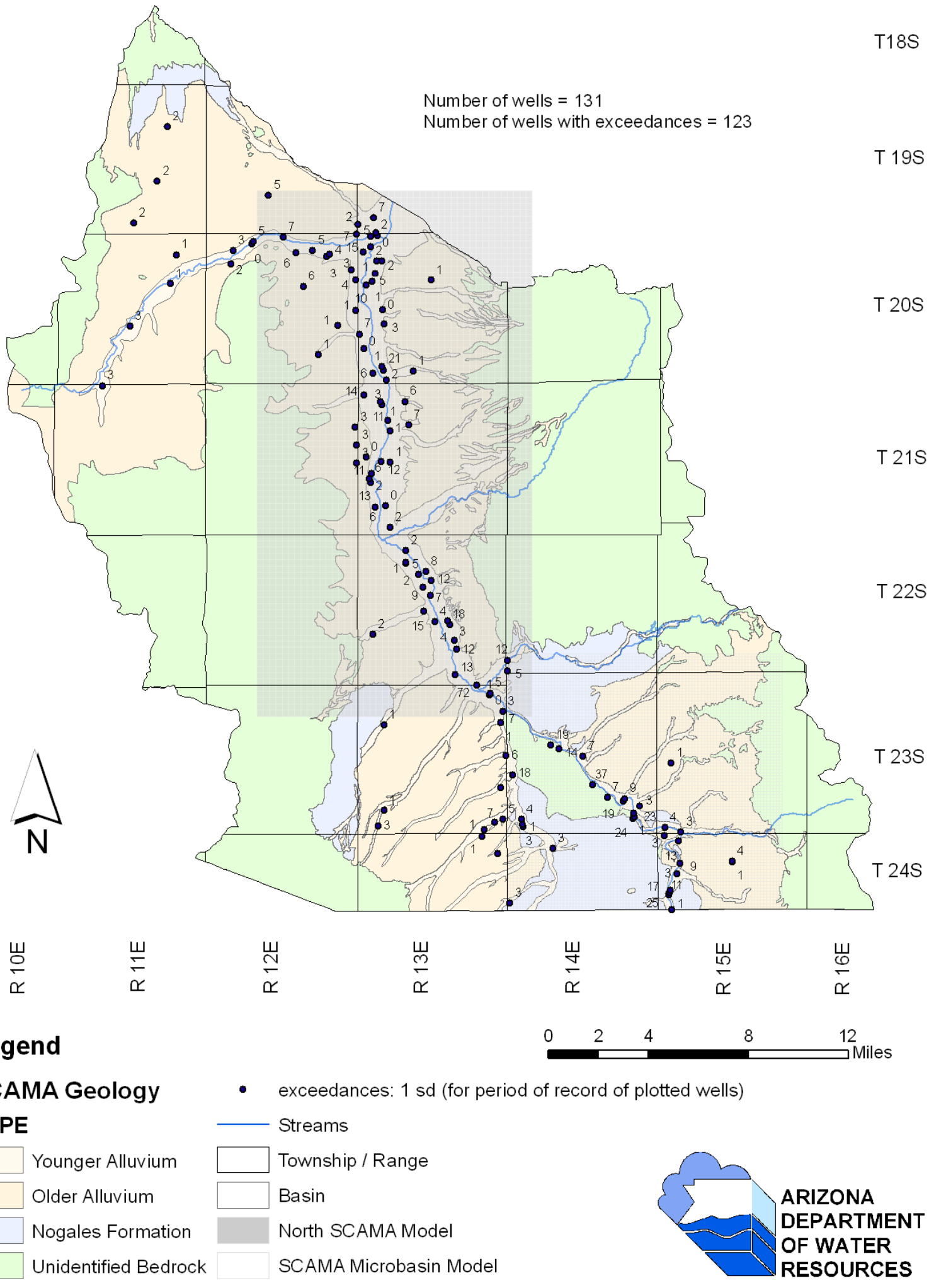


Figure 11: Santa Cruz AMA – Number of Exceedances for Plotted Wells Using a One Standard Deviation Target Threshold

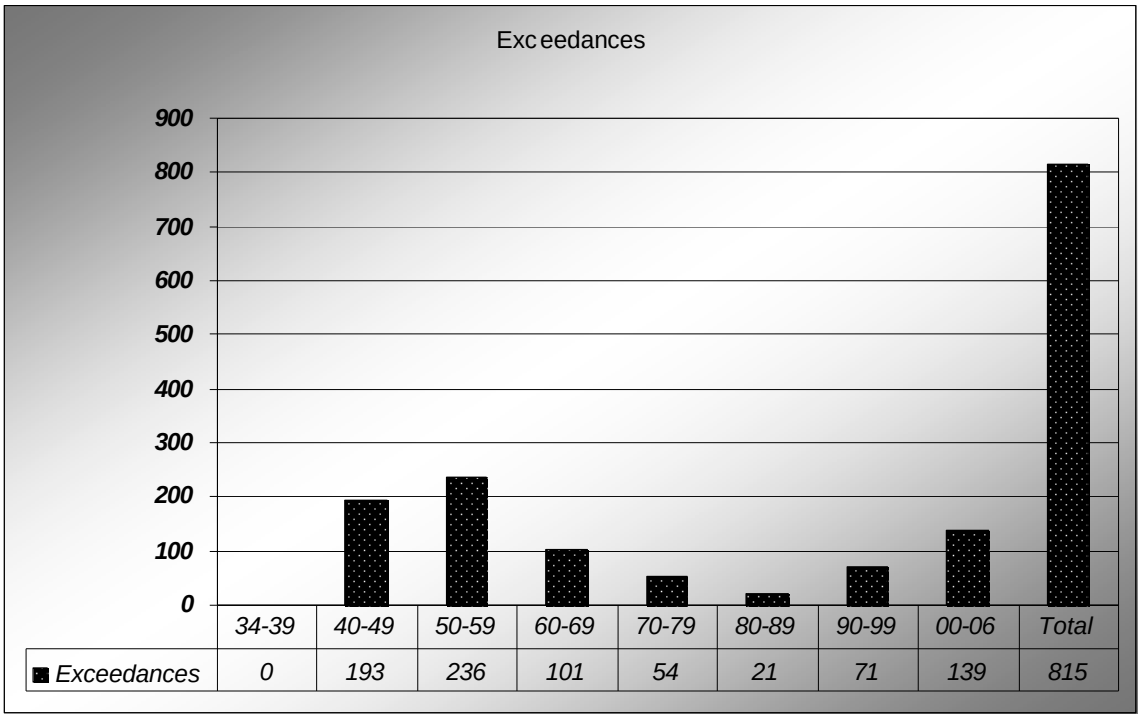


Figure 12: Number of One Standard Deviation DTW Exceedances Per Decade in the Santa Cruz AMA (1934-2006)

depth-to-water exceedances is related to the total number of depth-to-water measurements that were made during the various time periods (Figure 2). However, there is no doubt that the number of exceedances is also related to the climatic conditions that prevailed during each decade. For example, the 40's, 50's and the period from 2000-2006 were generally drier periods with lower than average streamflow and groundwater recharge (Figure 9).

It should be noted that while the proposed AWS rules require a one-standard deviation target threshold, a two-standard deviation threshold depth was also calculated for comparison purposes (Figure 13). As with projected water levels, an exceedance was determined to have occurred if the measured depth-to-water fell below the target threshold depth for any of the historic water level measurements that were analyzed. A comparison of the number of exceedances indicates that the use of a two-standard deviation target threshold significantly reduces the number of exceedances per well for most wells analyzed.

As previously mentioned, the proposed AWS criteria **do not allow projected depths** to water to exceed historic "target levels" for more than 12 consecutive months over the 100-year AWS projection period. Unfortunately, the **historic measurement** frequencies of the wells analyzed were insufficient to evaluate this particular requirement of the proposed rules for the historic past. For example, the historical water level measurements

for many wells are separated by varying periods of time that range from days to years. Therefore, it is generally not possible to determine how long a particular exceedance period may have lasted.

The data were also analyzed for groups of wells located in similar geographic and hydrogeologic sub-areas of the AMA. For example, the wells located in the younger alluvium in Sopori Wash were analyzed separately. Maximum dtw, minimum dtw, mean dtw, median dtw and one and two-standard deviation values were calculated for 13 groups of wells. It should be noted that the analysis of water levels for selected groups of wells was conducted to determine if there was any general consistency in observed historic hydrologic conditions for groupings of wells located in similar hydrogeologic areas. Review of the depth-to-water data shown in Figure 4 and summarized in Table 2 indicates that there is a general similarity in historical average depth-to-water conditions for many wells that are located in similar geographic and hydrogeologic sub-areas. Based these results it appears that some of the disparity in available measurement data per well could be handled by generalized averaging of data for multiple wells located in the same general hydrogeologic area that would result in area-specific rather than well-specific target threshold depths. However, the analysis of historic water level data for multiple wells located in the same general area does not indicate any plan to create numerous water management sub-areas within the AMA.

The results are presented in Table 2 and the wells within each of the 13 groups are shown in Figure 14. The wells with the greatest number of exceedances are in groups 7 and 11 (younger alluvium on the Santa Cruz River). As observed in Table 1, a comparison of the number of exceedances in Table 2 indicated the use of a two-standard deviation target threshold significantly reduced the number of exceedances in each of the 13 groups.

FIGURE 13
SCAMA - Number of Exceedances for Plotted Wells Using a Two Standard Deviation Target Threshold

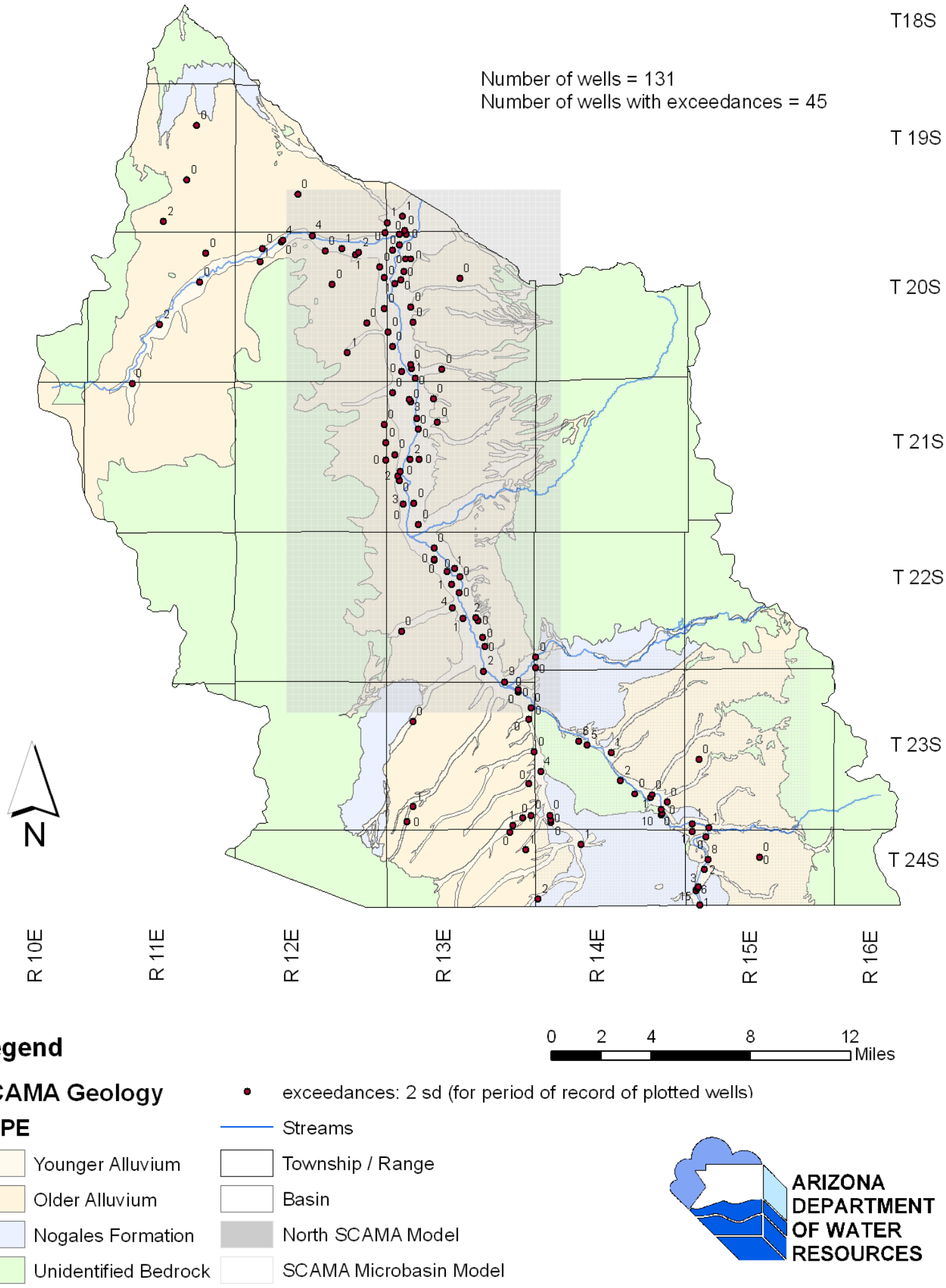


Figure 13: Santa Cruz AMA – Number of Exceedances for Plotted Wells Using a Two Standard Deviation Target Threshold

FIGURE 14
SCAMA - Well Groupings Used for Area Statistics

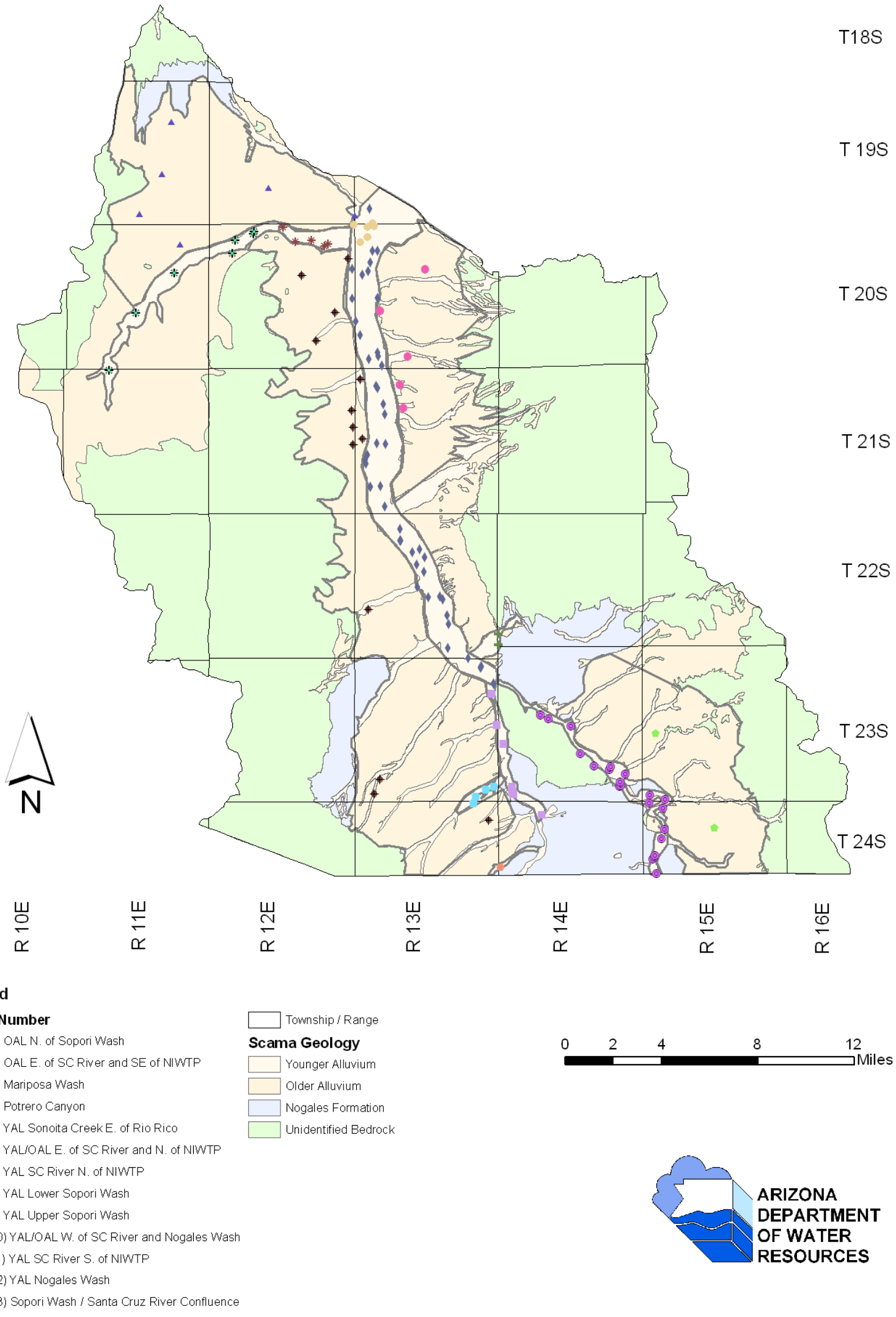


Figure 14: Santa Cruz AMA – Well Groupings Used for Area Statistics

Summary

A statistical analysis was completed to show how the proposed AWS target water level criteria relate to historic water level data for the Santa Cruz AMA. Historic depth-to-static water level measurements were used to calculate the weighted average historic depth-to-static water level for selected wells. One and two-standard deviation target threshold depths were calculated. The comparison of historic water levels to proposed target threshold depths indicated that there were a much larger number of exceedances of target threshold depths when a one-standard deviation target threshold was used.

Analysis of the available water level data revealed that the historic water level measurements in the Santa Cruz AMA were not made on a uniform or random basis, and the set of measurements are not necessarily normally distributed. The significance of this fact is that the average "historic" depths-to-static water level that have been calculated possess some degree of sampling bias, and do not necessarily represent the actual average historic depth-to-static water level. Nor do the averages for each well cover the same period of time. Several factors have been identified that have caused changes to perceived "average" groundwater conditions since the 1940's. The factors include changing surface flow regimes, the introduction of effluent and changing agricultural water uses have caused an overall rise in ground water levels since the mid-1950's along most of the Santa Cruz River YAL system. However, the drought over the last several years has caused a general lowering of water levels in many of the wells measured. Although the analysis showed that there is significant variability in the measurement frequencies and periods of records for different wells, the analysis indicated that some factors, such as the introduction of effluent and the non-uniform monthly distribution of water level measurements may have less overall "numeric" impact on the calculated averages than originally believed. The analysis clearly shows the statistical impact and need to use a weighted average for many wells with long periods of record that extend from the 1930's and 1940's to modern times and that have large disparities in sampling frequencies over their period of record

To summarize, the available water level data have sampling bias, and there are few locations in the AMA that have truly experienced "stationary" average groundwater conditions over the last 65 to 70 years. However, in spite of these short comings it seems like the historic water level measurements are the only significant source of information available that can be used to assign quantitative meaning to the requirement of the rules to "prevent local water tables from experiencing long-term declines". It is possible that the disparity in available measurement data per well could be handled, at least in part, by generalized averaging of data for multiple wells located in the same general hydrogeologic area that would result in area-specific rather than well-specific target threshold depths.

References

Erwin, G., 2007. Groundwater Flow Model Of the Santa Cruz Active Management Area Microbasins International Boundary to Nogales International Wastewater Treatment Plant Santa Cruz county, Arizona. Modeling Report No. 15.

Nelson, K., 2007A. Groundwater Flow Model Of the Santa Cruz Active Management Area Along The Effluent-Dominated Santa Cruz River Santa Cruz and Pima Counties, Arizona. Modeling Report No. 14.

Nelson, K., 2007B. Personal communication from Keith Nelson concerning pressure transducer data for well D-22-13 5ccb.

Table 1 – Historical Water Level Analysis in the Santa Cruz Active Management Area

TABLE 1 SUMMARY OF GROUNDWATER LEVEL MEASUREMENT DATA FOR SELECTED "TARGET" WELLS IN THE SANTA CRUZ AMA

Well #	LOCAL ID	AREA	Site ID	Well Reg. No. (55-******)	WELL ALT (Feet-MSL)	DATE FIRST DEPTH-TO-WATER (DTW) MEAS.	DATE LAST DEPTH-TO-WATER (DTW) MEAS.	TOTAL DTW MEAS. DURING PERIOD of RECORD (POR) (Count)	TOTAL YEARS WITH (ONE or MORE) DTW MEAS. (Count)	AVE. DTW DURING PERIOD of RECORD (POR)* (Feet)	AVE. DTW PRE72* (Feet)	Dif. DTW for POR-pre72 (Feet)	AVE. WL ELEV. DURING POR * (Feet)	MEDIAN DTW DURING POR (Feet)	MIN. DTW DURING POR (Feet)	MAX. DTW DURING POR (Feet)	1 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	2 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	1 STD Excd's (Count)	2 STD Excd's (Count)
1	D-24-15 18DCB UNSURV	YAL SC River S. of NIWTP	312006110505101	626375	3726	10/21/81	02/16/05	16	9	8.9			3717.3	8.6	6.6	14.7	2.6	5.2	1	1
2	D-24-14 18CBC	Mariposa Wash	312017110573001	603434	3960	02/18/82	10/26/05	29	21	207.9			3752.1	203.4	197.9	245.9	12.6	25.3	3	2
3	D-24-15 18BDA2UNSURV	YAL SC River S. of NIWTP	312037110510101		3713	06/11/48	12/06/76	303	29	6.7	6.7	0.0	3706.3	6.6	0.7	11.1	0.5	1.0	25	15
4	D-24-15 18BAD	YAL SC River S. of NIWTP	312048110504901		3712	11/02/39	03/28/06	133	33	10.0	9.8	0.2	3702.3	9.6	7.8	17.5	1.4	2.8	17	6
5	D-24-15 18AB1	YAL SC River S. of NIWTP	312050110504501	612625	3711	06/06/39	04/01/98	67	37	7.8	8.4	-0.6	3703.2	8.3	2.6	13.4	1.8	3.6	11	3
6	D-24-15 07ADC1UNSURV	YAL SC River S. of NIWTP	312121110504001	627782	3710	03/12/48	12/10/87	39	31	7.2	6.1	1.1	3702.8	6.2	3.4	20.8	3.7	7.4	3	2
7	D-24-15 04DDD2UNSURV	OAL E. of SC River and SE of NIWTP	312123110484201	625346	4018	02/26/73	02/17/05	14	13	280.9			3737.1	283.2	208.1	321.9	25.9	51.8	1	0
8	D-24-15 07AA UNSURV	YAL SC River S. of NIWTP	312136110504001		3700	06/24/41	02/22/65	44	24	8.7			3691.3	8.6	5.6	10.8	0.6	1.3	9	8
9	D-24-15 04DDD1	OAL E. of SC River and SE of NIWTP	312147110482801	625340	4011	02/23/82	10/26/05	27	20	95.9			3914.7	96.4	88.4	100.2	2.7	5.4	4	0
10	D-24-13 01DBD	OAL E. of SC River and SE of NIWTP	312204110575601	571751	3827	07/13/99	10/18/06	18	6	250.2			3576.8	243.3	241.6	285.0	17.1	34.1	1	1
11	D-24-14 05ADC4	YAL Nogales Wash	312214110554201		3740	02/08/54	01/13/67	15	13	22.4			3717.6	22.8	15.2	29.8	3.5	7.1	3	1
12	D-24-15 06AAD	YAL SC River S. of NIWTP	312230110503301	803465	3662	10/07/97	12/14/06	74	10	22.2			3639.9	21.2	3.4	33.9	6.7	13.5	13	0
13	D-24-13 01BBB1	Potrero Canyon	312238110583501	619171	3758	02/24/82	02/17/05	17	6	178.6			3579.4	185.5	163.7	190.3	11.5	22.9	1	0
14	D-23-15 31CDC	YAL SC River S. of NIWTP	312240110511001		3682	02/23/82	10/25/05	14	12	20.1			3661.9	20.0	17.7	24.0	1.9	3.7	3	1
15	D-23-15 31DDA	YAL SC River S. of NIWTP	312248110503001		3690	09/10/47	01/13/67	13	12	14.6			3675.4	10.7	8.2	30.2	7.6	15.2	3	1
16	D-23-13 36CBC	Potrero Canyon	312253110583101	603397	3745	02/08/54	11/17/99	16	15	159.5	148.2	11.3	3585.5	149.1	146.3	231.0	22.0	44.1	1	1
17	D-23-15 31CAC	YAL SC River S. of NIWTP	312258110510901	625359	3648	01/10/95	02/18/05	37	7	24.2			3623.6	22.6	9.2	40.1	7.9	15.7	4	1
18	D-23-14 31DBA2	YAL Nogales Wash	312300110565201	617054	3672	02/22/82	10/24/01	5	5	16.0			3656.0	16.5	11.9	18.9	2.6	5.3	1	0
19	D-23-13 31DAB	YAL/OAL W. of SC River and Nogales Wash	312301111024801	634030	4040	01/12/95	10/27/05	10	8	311.1			3728.9	310.1	307.4	314.3	2.8	5.6	3	0
20	D-23-14 31DBA1	YAL Nogales Wash	312308110565601		3650	02/08/54	01/13/67	11	9	9.0			3641.0	8.8	6.8	11.0	1.5	3.1	3	0
21	D-23-13 36BDD	Potrero Canyon	312308110580601	506340	3700	12/09/87	12/14/06	36	11	147.9			3552.1	148.3	140.8	155.6	4.4	8.8	7	0
22	D-23-14 31ACB	YAL Nogales Wash	312315110565801	603834	3657	12/09/87	02/29/00	10	4	15.2			3641.8	16.4	13.8	17.3	1.3	2.6	4	0
23	D-23-14 36BCB1	YAL SC River S. of NIWTP	312316110522701	603439	3616	03/15/40	10/18/06	270	58	29.2	21.2	7.9	3586.9	29.2	0.0	66.2	16.8	33.7	24	10
24	D-23-13 36ADB	Potrero Canyon	312316110574801	603432	3675	02/19/82	02/17/05	21	17	116.3			3558.7	119.1	100.5	130.1	9.9	19.7	5	0
25	D-23-14 36BBC	YAL SC River S. of NIWTP	312319110522301		3615	03/24/51	07/07/83	8	6	31.6	39.1	-7.5	3583.4	33.1	16.7	53.4	13.9	27.7	1	0
26	D-23-14 36BBB1	YAL SC River S. of NIWTP	312327110522501		3600	11/01/39	02/09/50	81	9	41.4			3558.6	43.5	20.2	50.3	5.6	11.3	23	0
27	D-23-13 29CCC	YAL/OAL W. of SC River and Nogales Wash	312334111023401	087349	3955	02/24/82	02/16/05	8	8	258.0			3697.0	256.0	254.3	267.6	4.6	9.3	1	1
28	D-23-14 25CDB	YAL SC River S. of NIWTP	312344110521001		3614	01/12/99	02/24/05	18	3	57.3			3556.3	54.1	31.9	67.3	8.3	16.6	3	0
29	D-23-14 26DBA	YAL SC River S. of NIWTP	312353110525101		3575	06/06/39	09/04/71	87	33	26.9			3548.1	27.0	9.3	39.1	6.0	12.1	19	1
30	D-23-14 26ACD	YAL SC River S. of NIWTP	312359110524801	801262	3610	11/13/47	06/23/82	48	32	36.7	33.3	3.4	3573.3	38.5	19.4	53.8	9.8	19.6	9	0
31	D-23-14 27ADD	YAL SC River S. of NIWTP	312400110532901	619646	3568	07/07/83	06/29/06	49	8	26.0			3542.1	25.3	11.5	46.4	10.9	21.9	7	0
32	D-23-14 22CDD1	YAL SC River S. of NIWTP	312421110535501		3561	10/31/39	02/29/00	172	50	17.0	17.7	-0.7	3543.6	18.2	12.3	24.2	2.7	5.4	37	2
33	D-23-13 24DDC	YAL SC River S. of NIWTP	312423110574901	500951	3597	02/22/82	10/26/05	13	12	51.1			3545.9	52.0	42.0	55.4	4.3	8.6	0	0
34	D-23-14 19BCD1	YAL Nogales Wash	312448110572001	619668	3550	10/18/39	12/09/87	98	38	12.1	12.4	-0.3	3537.9	12.4	6.9	17.9	2.3	4.6	18	4
35	D-23-15 19ABB	OAL E. of SC River and SE of NIWTP	312513110505401	805426	3902	02/22/82	10/25/05	11	9	138.4			3763.2	139.7	133.6	140.9	2.4	4.8	1	0
36	D-23-14 15CCB1	YAL SC River S. of NIWTP	312523110542801	607491	3557	12/01/64	12/19/06	48	16	37.8	30.8	7.0	3519.3	35.2	30.3	54.8	8.4	16.7	7	1
37	D-23-13 13DAD1	YAL Nogales Wash	312529110573601		3530	03/16/40	06/24/82	38	24	17.5	18.1	-0.6	3512.5	18.8	13.7	21.3	2.3	4.6	6	0
38	D-23-14 16BCC	YAL SC River S. of NIWTP	312545110552801	619649	3512	03/30/49	10/18/06	106	30	7.9	5.8	2.1	3504.1	7.8	3.6	21.1	4.0	7.9	14	5
39	D-23-14 17ACA	YAL SC River S. of NIWTP	312551110554701	619370	3510	06/07/39	01/12/95	67	42	15.3	15.7	-0.4	3494.7	14.8	11.6	21.9	2.3	4.5	19	6

TABLE 1 SUMMARY OF GROUNDWATER LEVEL MEASUREMENT DATA FOR SELECTED "TARGET" WELLS IN THE SANTA CRUZ AMA (cont.)

Well #	LOCAL ID	AREA	Site ID	Well Reg. No. (55-******)	WELL ALT (Feet-MSL)	DATE FIRST DEPTH-TO-WATER (DTW) MEAS.	DATE LAST DEPTH-TO-WATER (DTW) MEAS.	TOTAL DTW MEAS. DURING PERIOD of RECORD (POR) (Count)	TOTAL YEARS WITH (ONE or MORE) DTW MEAS. (Count)	AVE. DTW DURING PERIOD of RECORD (POR)* (Feet)	AVE. DTW PRE72* (Feet)	Dif. DTW for POR-pre72 (Feet)	AVE. WL ELEV. DURING POR * (Feet)	MEDIAN DTW DURING POR (Feet)	MIN. DTW DURING POR (Feet)	MAX. DTW DURING POR (Feet)	1 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	2 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	1 STD Excd's (Count)	2 STD Excd's (Count)
41	D-23-13 08CB UNSURV	YAL Nogales Wash	312633111023301		3535	02/25/82	10/25/05	4	4	8.2			3526.8	8.1	2.9	13.6	4.6	9.2	1	0
42	D-23-13 01DDC2	YAL SC River N. of NIWTP	312701110574301		3500	10/26/39	12/30/41	18	3	19.0			3481.0	23.6	12.2	29.5	6.2	12.3	7	0
43	D-23-13 01DDC1	YAL SC River N. of NIWTP	312701110574401		3460	02/01/52	01/13/67	13	12	21.8			3438.2	23.2	5.2	39.9	12.9	25.7	3	0
44	D-23-13 01BD2 UNSURV	YAL SC River N. of NIWTP	312735110581601	619354	3445	12/08/87	08/05/05	13	5	15.8			3429.2	16.6	4.7	24.2	7.2	14.5	1	0
45	D-23-13 01BD1 UNSURV	YAL SC River N. of NIWTP	312737110581501		3445	12/08/87	10/22/98	8	4	16.2			3428.8	16.2	10.1	20.2	4.3	8.7	0	0
46	D-23-13 01BBD UNSURV	YAL SC River N. of NIWTP	312740110581301	506506	3440	11/21/97	12/15/06	29	7	30.1			3409.9	31.8	11.8	44.0	9.9	19.8	5	0
47	D-22-13 35DCD UNSURV	YAL SC River N. of NIWTP	312756110584801	619351	3430	05/12/34	10/25/05	157	53	24.1	28.0	-3.9	3405.9	34.9	1.3	53.3	12.2	24.5	72	9
48	D-22-13 34ADD UNSURV	YAL SC River N. of NIWTP	312818110594501	619367	3401	11/02/51	10/25/05	47	32	18.9	22.0	-3.2	3382.1	17.5	7.5	42.9	9.9	19.8	13	2
49	D-22-13 36AD UNSURV	YAL Sonoita Creek E. of Rio Rico	312823110573501	619352	3471	05/07/87	09/13/06	35	8	37.7			3433.3	40.3	16.9	55.0	12.4	24.8	5	0
50	D-22-13 25DDD UNSURV	YAL Sonoita Creek E. of Rio Rico	312848110573201	619371	3482	07/07/39	10/31/00	68	50	70.4	81.2	-10.8	3411.6	73.4	39.3	99.7	15.4	30.9	12	0
51	D-22-13 27ADD UNSURV	YAL SC River N. of NIWTP	312910110593701		3385	06/22/40	02/01/79	52	31	17.9	19.1	-1.2	3367.1	19.2	2.9	36.8	9.9	19.9	12	0
52	D-22-13 27AAB UNSURV	YAL SC River N. of NIWTP	312929110594201	619353	3381	06/13/39	10/27/05	17	14	18.7	27.2	-8.5	3362.3	16.2	7.5	38.3	10.8	21.6	3	0
53	D-22-13 19DCC UNSURV	YAL/OAL W. of SC River and Nogales Wash	312946111025301	524009	3518	01/10/95	10/27/05	10	9	194.2			3323.9	194.3	190.5	197.9	2.1	4.2	2	0
54	D-22-13 22ACD UNSURV	YAL SC River N. of NIWTP	313003110595301		3344	01/28/52	01/12/67	15	14	19.1			3324.9	19.8	3.4	39.9	10.6	21.3	4	0
55	D-22-13 22BCB UNSURV	YAL SC River N. of NIWTP	313008111003001		3370	02/16/82	11/17/98	16	5	10.5			3359.5	11.7	9.2	13.4	1.3	2.6	4	1
56	D-22-13 22ACB UNSURV	YAL SC River N. of NIWTP	313010110595901	619363	3362	03/16/48	08/05/05	79	32	15.7	18.1	-2.5	3346.3	17.8	2.0	36.3	10.1	20.2	18	2
57	D-22-13 16DC1 UNSURV	YAL SC River N. of NIWTP	313031111005701		3355	10/25/39	02/01/79	68	27	16.8	18.2	-1.4	3338.2	18.2	5.1	41.1	7.2	14.3	15	4
58	D-22-13 16ADA1UNSURV	YAL SC River N. of NIWTP	313103111004001	606780	3335	06/02/43	03/01/00	33	26	21.6	24.0	-2.4	3313.4	26.8	5.9	42.5	11.6	23.3	7	0
59	D-22-13 09DCC UNSURV	YAL SC River N. of NIWTP	313120111005801	605206	3333	01/09/95	12/19/06	69	11	17.8			3315.2	16.9	11.7	25.1	3.5	7.1	9	1
60	D-22-13 09DA2 UNSURV	YAL SC River N. of NIWTP	313137111004301	619348	3327	04/01/40	10/27/05	55	34	24.5	29.3	-4.8	3302.5	26.7	7.7	43.8	10.2	20.4	12	0
61	D-22-13 09BDD3UNSURV	YAL SC River N. of NIWTP	313145111010601	507133	3320	01/09/95	08/05/05	8	3	12.5			3307.5	11.8	6.9	18.2	5.0	10.1	2	0
62	D-22-13 09AC UNSURV	YAL SC River N. of NIWTP	313150111005801	619368	3330	10/26/39	02/16/05	44	36	26.2	28.9	-2.7	3303.8	26.6	14.5	48.1	8.0	16.0	8	1
63	D-22-13 05DD2 UNSURV	YAL SC River N. of NIWTP	313211111014001	619360	3310	01/09/95	02/16/05	9	8	13.8			3296.2	13.8	9.7	17.0	2.0	4.0	1	0
64	D-22-13 05DD1 UNSURV	YAL SC River N. of NIWTP	313217111014101	619350	3310	10/24/39	01/11/95	28	26	24.5	25.0	-0.5	3285.5	24.9	10.8	37.7	7.6	15.1	5	0
65	D-22-13 05DAA UNSURV	YAL SC River N. of NIWTP	313236111014101		3313	01/25/52	02/05/69	12	11	25.1			3287.9	27.7	10.6	35.4	8.8	17.6	2	0
66	D-21-13 32CAB	YAL SC River N. of NIWTP	313325111021901		3292	01/25/52	01/12/67	14	13	31.7			3260.3	32.7	19.2	39.7	6.0	12.0	2	0
67	D-21-13 30DC UNSURV	YAL SC River N. of NIWTP	313406111330201	629110	3250	03/04/60	01/11/95	16	10	10.9	11.4	-0.5	3239.1	12.2	6.8	15.1	3.0	6.0	6	0
68	D-21-13 30DCA	YAL SC River N. of NIWTP	313408111025601		3250	12/11/97	12/19/06	49	10	11.8			3238.2	11.9	10.0	13.6	0.5	0.9	13	3
69	D-21-13 29CBC UNSURV	YAL SC River N. of NIWTP	313411111023401	609182	3252	01/25/52	03/23/05	8	7	15.0	20.6	-5.6	3237.0	19.1	7.3	21.7	7.1	14.1	0	0
70	D-21-13 19DCB	YAL SC River N. of NIWTP	313458111030701		3240	10/16/39	07/27/45	32	7	27.9			3212.1	26.8	24.4	31.3	1.9	3.9	2	0
71	D-21-13 19DBC	YAL SC River N. of NIWTP	313506111030701	617995	3240	02/07/73	10/25/05	34	26	24.2			3215.8	23.7	19.5	29.6	2.4	4.8	6	2
72	D-21-13 19ACC	YAL SC River N. of NIWTP	313517111030401		3236	07/27/39	01/13/72	82	33	29.2	29.5	-0.4	3206.8	27.8	17.3	39.3	6.3	12.5	11	0
73	D-21-12 24AAA	YAL/OAL W. of SC River and Nogales Wash	313539111033701	509495	3380	12/08/93	10/25/05	14	11	154.0			3226.0	154.2	151.1	157.1	1.8	3.6	3	0
74	D-21-13 18DD UNSURV	YAL SC River N. of NIWTP	313542111024001	604488	3215	07/27/39	01/10/95	62	29	15.7	17.0	-1.3	3199.3	15.4	7.3	27.3	5.5	11.0	12	2
75	D-21-13 17CDC1	YAL SC River N. of NIWTP	313543111021701		3216	01/23/52	03/31/05	12	11	19.6	22.2	-2.6	3196.4	22.3	6.3	26.1	6.2	12.5	1	0
76	D-21-13 18CDB2	YAL/OAL W. of SC River and Nogales Wash	313551111031701	516278	3330	01/11/95	03/01/05	9	5	130.1			3199.9	130.5	127.9	131.3	1.3	2.6	0	0
77	D-21-12 13ADA	YAL/OAL W. of SC River and Nogales Wash	313617111034001	632944	3318	01/01/72	03/01/05	12	12	128.5			3189.5	128.2	124.4	133.7	3.2	6.3	3	0
78	D-21-13 08CDB	YAL SC River N. of NIWTP	313643111021701	604368	3200	01/22/52	03/05/96	9	8	27.6	30.5	-2.9	3172.4	29.7	18.7	33.6	5.6	11.2	1	0
79	D-21-12 12DAA	YAL/OAL W. of SC River and Nogales Wash	313654111034401		3300	11/13/52	03/01/05	25	22	132.3	133.8	-1.5	3167.7	135.3	119.6	139.6	6.3	12.6	3	0
80	D-21-13 09BCC	YAL/OAL E. of SC River and N. of NIWTP	313659111013301		3250	11/13/52	12/14/87	31	29	73.7	75.7	-2.1	3176.3	72.6	68.0	79.0	4.0	7.9	7	0

TABLE 1 SUMMARY OF GROUNDWATER LEVEL MEASUREMENT DATA FOR SELECTED "TARGET" WELLS IN THE SANTA CRUZ AMA (cont.)

Well #	LOCAL ID	AREA	Site ID	Well Reg. No. (55-******)	WELL ALT (Feet-MSL)	DATE FIRST DEPTH-TO-WATER (DTW) MEAS.	DATE LAST DEPTH-TO-WATER (DTW) MEAS.	TOTAL DTW MEAS. DURING PERIOD of RECORD (POR) (Count)	TOTAL YEARS WITH (ONE or MORE) DTW MEAS. (Count)	AVE. DTW DURING PERIOD of RECORD (POR)* (Feet)	AVE. DTW PRE72* (Feet)	Dif. DTW for POR-pre72 (Feet)	AVE. WL ELEV. DURING POR * (Feet)	MEDIAN DTW DURING POR (Feet)	MIN. DTW DURING POR (Feet)	MAX. DTW DURING POR (Feet)	1 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	2 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	1 STD Excd's (Count)	2 STD Excd's (Count)
82	D-21-13 05CCB	YAL SC River N. of NIWTP	313735111023701	608125	3174	06/09/97	12/15/06	39	10	16.1			3157.8	15.9	13.4	18.5	0.8	1.5	11	3
83	D-21-13 06DAA	YAL SC River N. of NIWTP	313747111023901	608112	3175	03/01/60	10/26/05	16	14	26.3	32.7	-6.4	3148.7	24.9	18.2	35.1	5.4	10.9	3	0
84	D-21-13 05DAA	YAL/OAL E. of SC River and N. of NIWTP	313748111014301	633078	3238	03/12/53	02/17/05	31	30	76.6	80.1	-3.5	3161.4	76.0	67.3	84.6	4.7	9.5	6	0
85	D-21-13 06BCA	YAL/OAL W. of SC River and Nogales Wash	313801111032301		3230	03/19/40	02/23/82	59	38	101.4	102.4	-1.0	3128.6	100.8	94.0	108.2	4.6	9.3	14	0
86	D-20-11 32DDD	YAL Upper Sopori Wash	313817111141001	616246	3548	02/26/82	10/24/05	11	10	34.1			3513.9	34.4	29.8	41.3	3.8	7.7	3	0
87	D-20-13 32CCB	YAL SC River N. of NIWTP	313832111022801	610532	3149	06/23/44	03/11/82	36	19	26.0	26.4	-0.5	3123.0	27.7	12.3	31.4	4.9	9.8	2	0
88	D-20-13 32BCC	YAL SC River N. of NIWTP	313845111023101	610533	3151	06/15/39	06/29/06	153	44	29.2	30.4	-1.2	3121.4	28.8	17.6	40.1	5.2	10.5	21	1
89	D-20-13 31ACC	YAL SC River N. of NIWTP	313849111030001	610530	3145	07/02/48	02/01/77	78	24	35.1	35.4	-0.2	3109.9	38.8	21.6	43.8	6.5	13.0	6	0
90	D-20-13 33BCA4	YAL/OAL E. of SC River and N. of NIWTP	313851111012201	616320	3292	02/01/65	12/15/87	17	16	173.1	176.1	-3.0	3118.9	174.5	160.1	179.5	4.4	8.7	1	0
91	D-20-13 31AAC	YAL SC River N. of NIWTP	313859111023901		3139	10/01/39	05/19/05	28	20	26.6	28.6	-2.0	3112.4	29.3	12.0	33.8	7.2	14.3	1	0
92	D-20-12 26CAD2	YAL/OAL W. of SC River and Nogales Wash	313915111052001	804782	3290	02/23/82	10/26/05	11	10	171.9			3118.1	170.9	167.2	185.1	5.2	10.3	1	1
93	D-20-13 30BCD	YAL SC River N. of NIWTP	313939111032401		3124	01/22/52	02/15/05	33	20	35.0	38.8	-3.8	3089.0	39.2	17.1	42.8	8.2	16.4	0	0
94	D-20-13 19CCC	YAL SC River N. of NIWTP	314008111033501	623095	3126	10/16/39	02/15/05	53	30	45.7	46.8	-1.1	3080.3	44.3	30.0	58.9	6.7	13.4	7	0
95	D-20-11 21DAA	YAL Upper Sopori Wash	314024111125301		3449	06/22/64	10/24/05	31	22	46.4	48.6	-2.3	3402.6	46.6	31.3	56.4	4.7	9.4	3	2
96	D-20-12 24CBA	YAL/OAL W. of SC River and Nogales Wash	314028111042601	612085	3200	02/26/65	02/17/05	14	14	121.4	123.6	-2.2	3078.6	122.3	107.7	131.2	5.9	11.8	1	0
97	D-20-13 20CBB	YAL/OAL E. of SC River and N. of NIWTP	314029111023301	651503	3175	03/11/53	02/15/05	35	32	100.9	104.7	-3.8	3074.1	100.4	84.4	109.3	6.7	13.4	3	0
98	D-20-13 18CDD	YAL SC River N. of NIWTP	314058111031001	617276	3096	02/28/52	01/12/95	26	22	29.2	30.3	-1.1	3066.8	33.1	6.9	36.6	7.8	15.6	0	0
99	D-20-12 13DDD	YAL SC River N. of NIWTP	314058111034301	623097	3102	01/22/52	01/11/67	14	13	44.7			3057.3	45.5	31.9	49.9	4.4	8.7	1	0
100	D-20-12 10DDC	YAL/OAL W. of SC River and Nogales Wash	314148111055101	804788	3285	11/06/52	01/09/95	33	29	288.7	286.9	1.7	2996.3	289.2	272.3	296.5	6.2	12.3	6	0
101	D-20-13 07CDC	YAL SC River N. of NIWTP	314150111031701		3070	06/16/39	01/12/95	57	37	26.2	26.8	-0.6	3043.8	25.4	8.4	37.0	4.5	9.1	10	1
102	D-20-11 11DCC2	YAL Upper Sopori Wash	314152111111601	801469	3380	01/09/95	10/24/05	8	8	44.5			3335.5	44.9	42.4	46.2	1.4	2.7	1	0
103	D-20-13 07DCB	YAL SC River N. of NIWTP	314156111030301		3067	01/22/52	03/02/00	12	11	29.4	33.5	-4.1	3037.6	34.2	8.4	41.8	10.1	20.3	1	0
104	D-20-13 09DDD	YAL/OAL E. of SC River and N. of NIWTP	314157111003701	611218	3454	11/08/72	02/15/05	7	7	239.8			3214.7	241.1	230.3	244.7	4.6	9.3	1	0
105	D-20-12 12DAD	YAL SC River N. of NIWTP	314202111034001	801397	3089	07/30/81	10/26/05	14	12	39.1			3049.9	38.4	29.1	48.7	6.3	12.5	4	0
106	D-20-13 07ACD	YAL SC River N. of NIWTP	314214111025601	617275	3063	01/11/95	12/19/06	69	11	18.3			3044.7	17.9	8.3	27.2	5.1	10.3	5	0
107	D-20-12 12ACA	YAL/OAL W. of SC River and Nogales Wash	314224111035401		3130	02/14/64	01/29/71	9	7	91.0			3039.0	89.0	84.2	100.6	5.9	11.7	3	0
108	D-20-12 07AAA	YAL Upper Sopori Wash	314236111084901	612081	3290	02/25/58	03/04/05	13	13	25.1	24.8	0.3	3264.9	25.0	23.5	27.7	1.2	2.5	2	1
109	D-20-13 06DDD	YAL SC River N. of NIWTP	314242111023901		3054	01/22/52	01/11/67	15	14	37.0			3017.0	38.2	26.1	42.4	4.2	8.4	2	0
110	D-20-13 06DDC	YAL SC River N. of NIWTP	314242111025201	625121	3043	03/01/56	01/11/95	14	12	26.5	29.9	-3.4	3016.5	31.0	5.2	37.4	9.2	18.5	1	0
111	D-20-12 02DCA	YAL Lower Sopori Wash	314251111045401	612069	3123	11/06/52	03/04/05	28	25	140.1	137.2	3.0	2982.9	139.4	128.0	155.7	7.5	14.9	3	1
112	D-20-11 02DAC	OAL N. of Sopori Wash	314255111110201	616299	3440	06/24/64	02/17/05	8	8	117.7	117.6	0.1	3322.3	118.1	114.2	121.1	2.1	4.2	1	0
113	D-20-12 02DAC	YAL Lower Sopori Wash	314256111044601	612070	3112	01/03/55	12/09/96	34	27	130.6	129.1	1.5	2981.4	127.2	118.6	158.0	10.8	21.5	4	2
114	D-20-12 03DBC	YAL Lower Sopori Wash	314300111060901	612074	3157	04/15/46	01/09/95	32	26	168.2	167.0	1.3	2988.8	167.3	153.5	182.5	7.2	14.4	6	0
115	D-20-12 02CBA	YAL Lower Sopori Wash	314302111052901	612068	3133	06/01/43	03/04/05	35	23	153.3	150.8	2.5	2979.7	151.4	133.5	179.2	12.7	25.5	5	1
116	D-20-13 06CBA	Sopori Wash / Santa Cruz River Confluence	314303111032801	627932	3064	11/17/47	10/26/05	81	53	45.3	51.3	-6.0	3018.7	50.1	27.8	59.4	8.8	17.6	15	0
117	D-20-12 05CBB	YAL Upper Sopori Wash	314304111084301	625246	3272	02/25/58	03/04/05	28	26	19.9	19.0	0.9	3252.1	20.2	16.3	23.1	1.7	3.4	3	0
118	D-20-13 06ACC	Sopori Wash / Santa Cruz River Confluence	314312111030601	625122	3052	03/22/45	02/23/00	35	23	44.3	45.6	-1.3	3007.7	45.4	19.9	52.7	7.0	14.0	2	0
119	D-20-12 05ADB2	YAL Upper Sopori Wash	314318111075401	621510	3224	11/19/01	10/24/05	8	5	19.9			3204.1	20.5	18.1	21.0	1.1	2.2	0	0
120	D-20-12 05AAC	YAL Upper Sopori Wash	314321111075001	640384	3200	05/14/03	12/15/06	12	4	15.9			3184.1	16.1	14.1	16.9	0.3	0.5	5	4
121	D-20-12 03BBB	YAL Lower Sopori Wash	314332111064001	612066	3175	10/23/51	10/21/98	51	40	169.4	171.1	-1.7	3005.6	168.4	157.0	184.4	5.9	11.8	7	4

TABLE 1 SUMMARY OF GROUNDWATER LEVEL MEASUREMENT DATA FOR SELECTED "TARGET" WELLS IN THE SANTA CRUZ AMA (cont.)

Well #	LOCAL ID	AREA	Site ID	Well Reg. No. (55-******)	WELL ALT (Feet-MSL)	DATE FIRST DEPTH-TO-WATER (DTW) MEAS.	DATE LAST DEPTH-TO-WATER (DTW) MEAS.	TOTAL DTW MEAS. DURING PERIOD of RECORD (POR) (Count)	TOTAL YEARS WITH (ONE or MORE) DTW MEAS. (Count)	AVE. DTW DURING PERIOD of RECORD (POR)* (Feet)	AVE. DTW PRE72* (Feet)	Dif. DTW for POR-pre72 (Feet)	AVE. WL ELEV. DURING POR * (Feet)	MEDIAN DTW DURING POR (Feet)	MIN. DTW DURING POR (Feet)	MAX. DTW DURING POR (Feet)	1 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	2 STD. DEV. FROM AVE. DTW DURING (POR) (Feet)	1 STD Excd's (Count)	2 STD Excd's (Count)
123	D-19-13 31DDC	Sopori Wash / Santa Cruz River Confluence	314335111025001	625125	3042	12/21/51	11/19/68	18	15	44.6			2997.4	46.3	21.3	50.3	6.8	13.6	0	0
124	D-19-12 36DDD	Sopori Wash / Santa Cruz River Confluence	314336111034101	629430	3067	10/01/39	02/14/05	28	26	80.2	79.6	0.6	2986.8	79.0	64.4	92.6	7.3	14.6	7	0
125	D-19-13 31DDB	Sopori Wash / Santa Cruz River Confluence	314342111025401	625124	3041	01/22/52	01/10/66	12	11	45.3			2995.7	45.5	41.6	49.2	2.3	4.5	2	0
126	D-19-13 31BCC	OAL N. of Sopori Wash	314359111033701		3084	01/28/52	01/10/66	12	11	107.5			2976.5	106.6	99.5	120.9	6.4	12.9	2	1
127	D-19-11 34BCC	OAL N. of Sopori Wash	314401111124501	616247	3640	02/25/82	10/26/05	11	10	175.3			3464.7	175.3	174.1	176.9	0.7	1.4	2	2
128	D-19-13 31ABD	Sopori Wash / Santa Cruz River Confluence	314413111030001		3042	11/21/97	10/18/06	66	10	64.1			2977.9	62.0	52.6	75.5	5.6	11.3	7	1
129	D-19-12 28BDA	OAL N. of Sopori Wash	314458111071601	625251	3328	06/17/64	03/04/05	20	16	350.5	351.4	-0.9	2977.5	350.2	346.8	354.8	2.6	5.1	5	0
130	D-19-11 23CCB	OAL N. of Sopori Wash	314526111114901	625265	3555	01/06/82	10/24/05	12	10	176.1			3378.9	174.9	169.6	182.9	3.9	7.8	2	0
131	D-19-11 11CAC	OAL N. of Sopori Wash	314716111113101	616245	3825	01/07/82	03/02/05	9	8	210.8			3614.2	210.5	208.9	213.9	1.8	3.7	2	0

Footnotes:

* Weighted Average DTW calculated using method described in text.

ALT = Altitude | WL = Water Level | STD DEV = Standard Deviation

DTW = Depth to Water | MSL - Mean Sea Level | Excd's = Exceedances

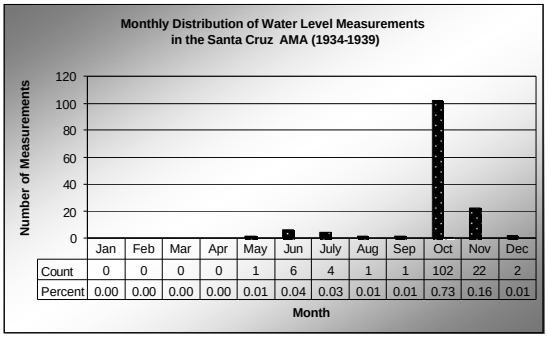
Table 2 – Group Calculations Summary for the Santa Cruz Active Management Area

TABLE 2 SUMMARY OF CALCULATION DATA PER GROUP IN THE SANTA CRUZ AMA											
Group #	**Name of Well Grouping**	**Date First WL Measured**	**Date Last WL Measured**	**Max DTW (ft)**	**Min DTW (ft)**	**Mean DTW (ft)**	**Mean One STD Dev (ft)**	**Mean Two STD Dev (ft)**	**Number of Wells**	**Count of 1 STD Dev Excd's**	**Count of 2 STD Dev Excd's**
1	OAL N. of Sopori Wash	01/28/52	10/26/05	354.8	99.5	189.6	2.9	5.8	6	14	3
2	OAL E. of SC River and SE of NIWTP	02/26/73	10/26/05	321.9	88.4	171.7	10.3	20.7	3	6	0
3	Mariposa Wash	02/18/82	10/26/05	245.9	197.9	207.9	12.6	25.3	1	3	2
4	Potrero Canyon	02/08/54	12/14/06	231.0	100.5	150.6	11.9	23.9	4	14	1
5	YAL Sonoita Creek E. of Rio Rico	07/07/39	09/13/06	99.7	16.9	54.0	13.9	27.8	2	17	0
6	YAL/OAL E. of SC River and N. of NIWTP	11/13/52	02/17/05	244.7	67.3	132.8	4.9	9.8	5	18	0
7	YAL SC River N. of NIWTP	05/12/34	12/19/06	75.5	1.3	24.4	6.5	13.0	49	340	33
8	YAL Lower Sopori Wash	06/01/43	03/04/05	184.4	118.6	152.3	8.8	17.6	5	25	8
9	YAL Upper Sopori Wash	02/25/58	12/15/06	56.4	14.1	29.4	2.0	4.1	7	17	7
10	YAL/OAL W. of SC River and Nogales Wash	03/19/40	10/18/06	314.3	84.2	179.4	5.1	10.3	13	41	3
11	YAL SC River S. of NIWTP	06/06/39	12/19/06	67.3	0.0	21.8	5.9	11.8	21	252	63
12	YAL Nogales Wash	10/18/39	10/25/05	29.8	2.9	15.4	2.6	5.1	8	37	5
13	Sopori Wash / Santa Cruz River Confluence	10/01/39	10/26/05	92.6	19.9	51.3	6.2	12.5	6	31	0

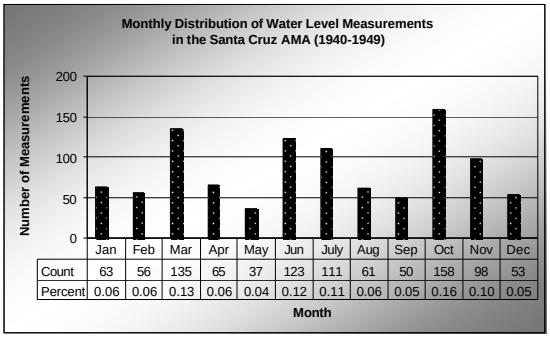
Footnotes:

STD Dev = Standard Deviation
WL = Water Level
Excd's = Exceedances
ft = Feet
DTW = Depth to Water

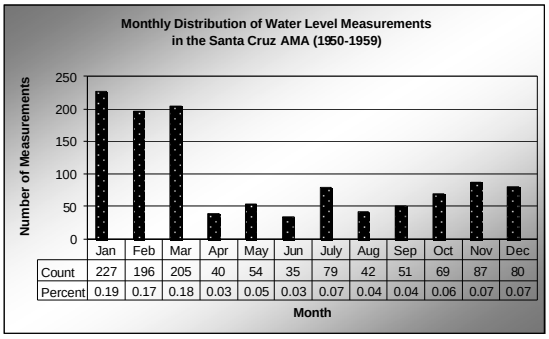
Appendix A – Monthly distributions of water level measurements per decade



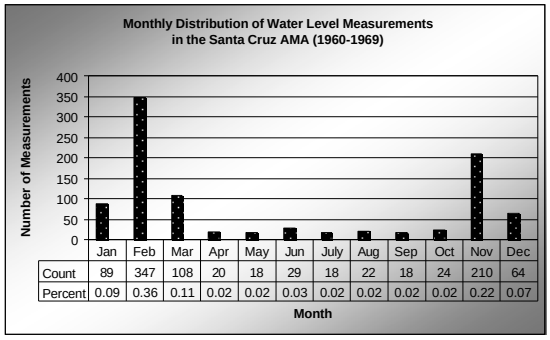
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Count	0	0	0	0	1	6	4	1	1	102	22	2
Percent	0.00	0.00	0.00	0.00	0.01	0.04	0.03	0.01	0.01	0.73	0.16	0.01



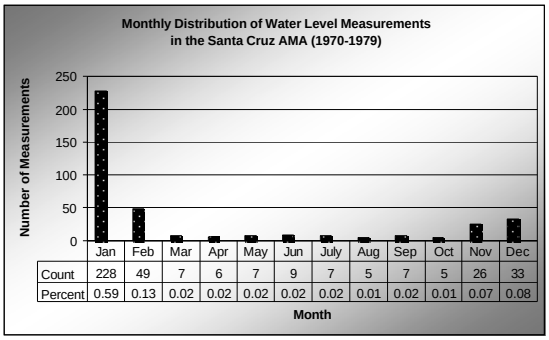
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Count	63	56	135	65	37	123	111	61	50	158	98	53
Percent	0.06	0.06	0.13	0.06	0.04	0.12	0.11	0.06	0.05	0.16	0.10	0.05



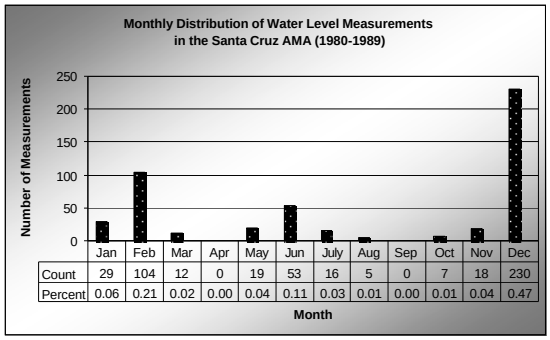
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Count	227	196	205	40	54	35	79	42	51	69	87	80
Percent	0.19	0.17	0.18	0.03	0.05	0.03	0.07	0.04	0.04	0.06	0.07	0.07



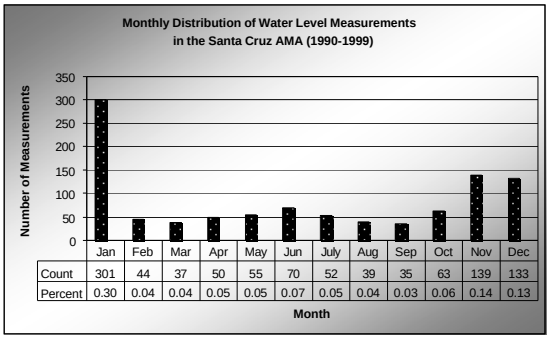
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Count	89	347	108	20	18	29	18	22	18	24	210	64
Percent	0.09	0.36	0.11	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.22	0.07



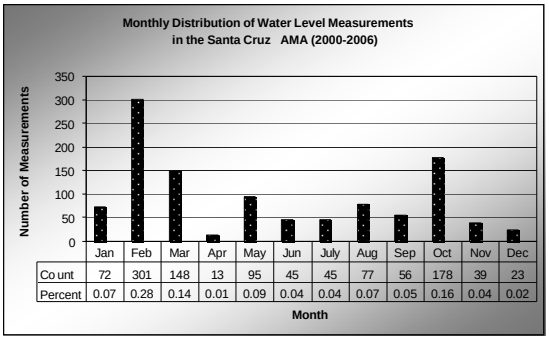
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Count	228	49	7	6	7	9	7	5	7	5	26	33
Percent	0.59	0.13	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.07	0.08



	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Count	29	104	12	0	19	53	16	5	0	7	18	230
Percent	0.06	0.21	0.02	0.00	0.04	0.11	0.03	0.01	0.00	0.01	0.04	0.47

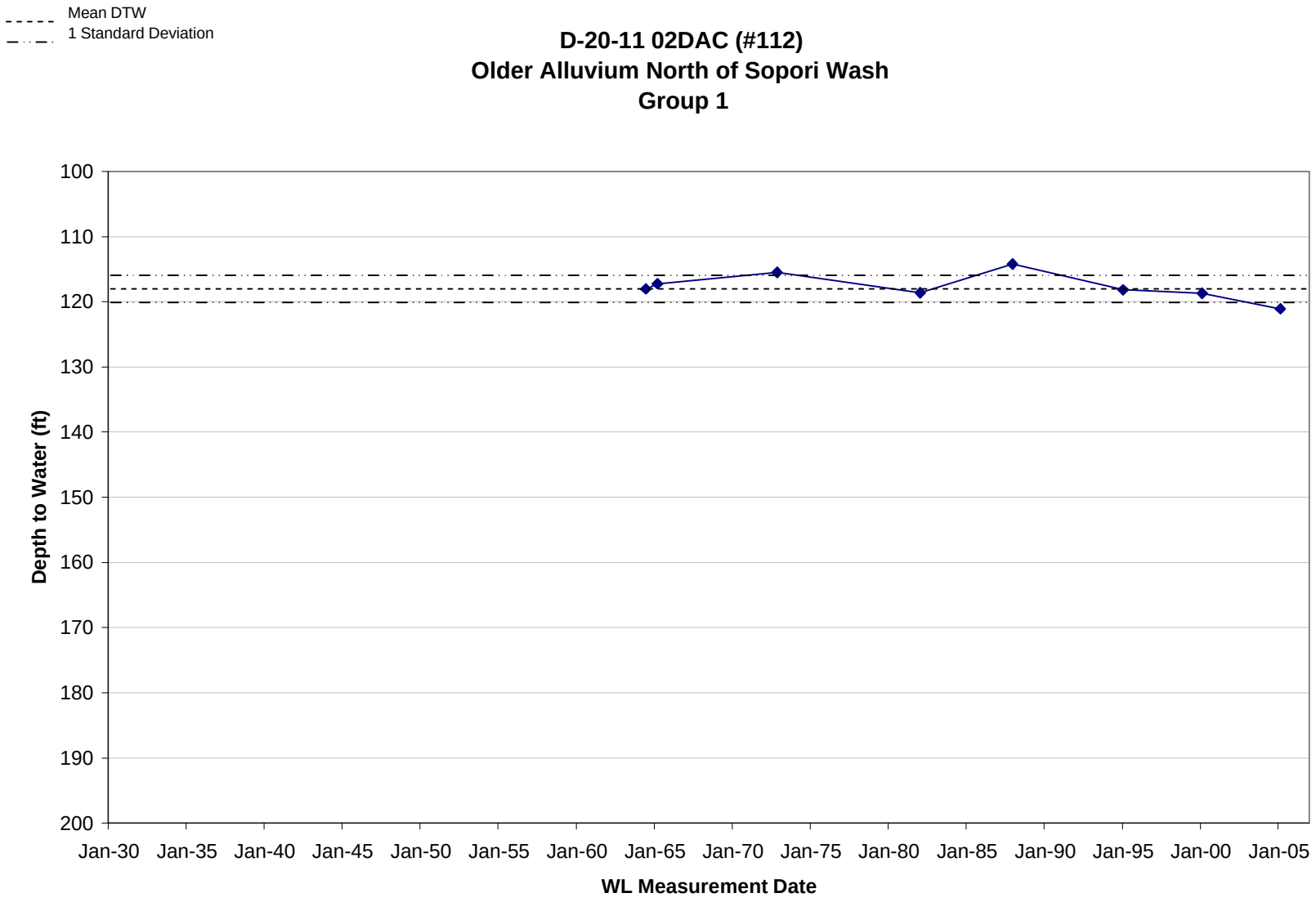


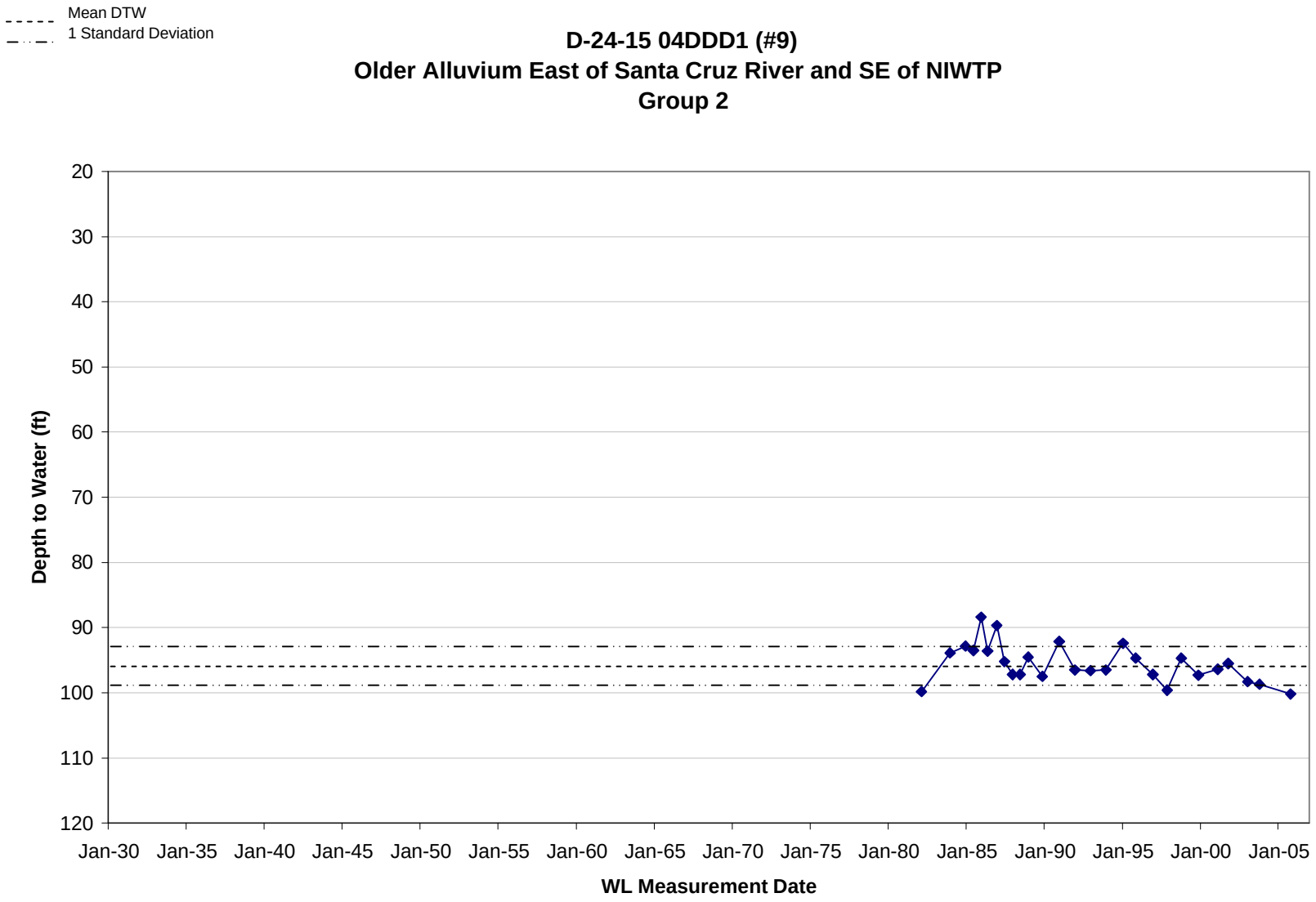
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Count	301	44	37	50	55	70	52	39	35	63	139	133
Percent	0.30	0.04	0.04	0.05	0.05	0.07	0.05	0.04	0.03	0.06	0.14	0.13

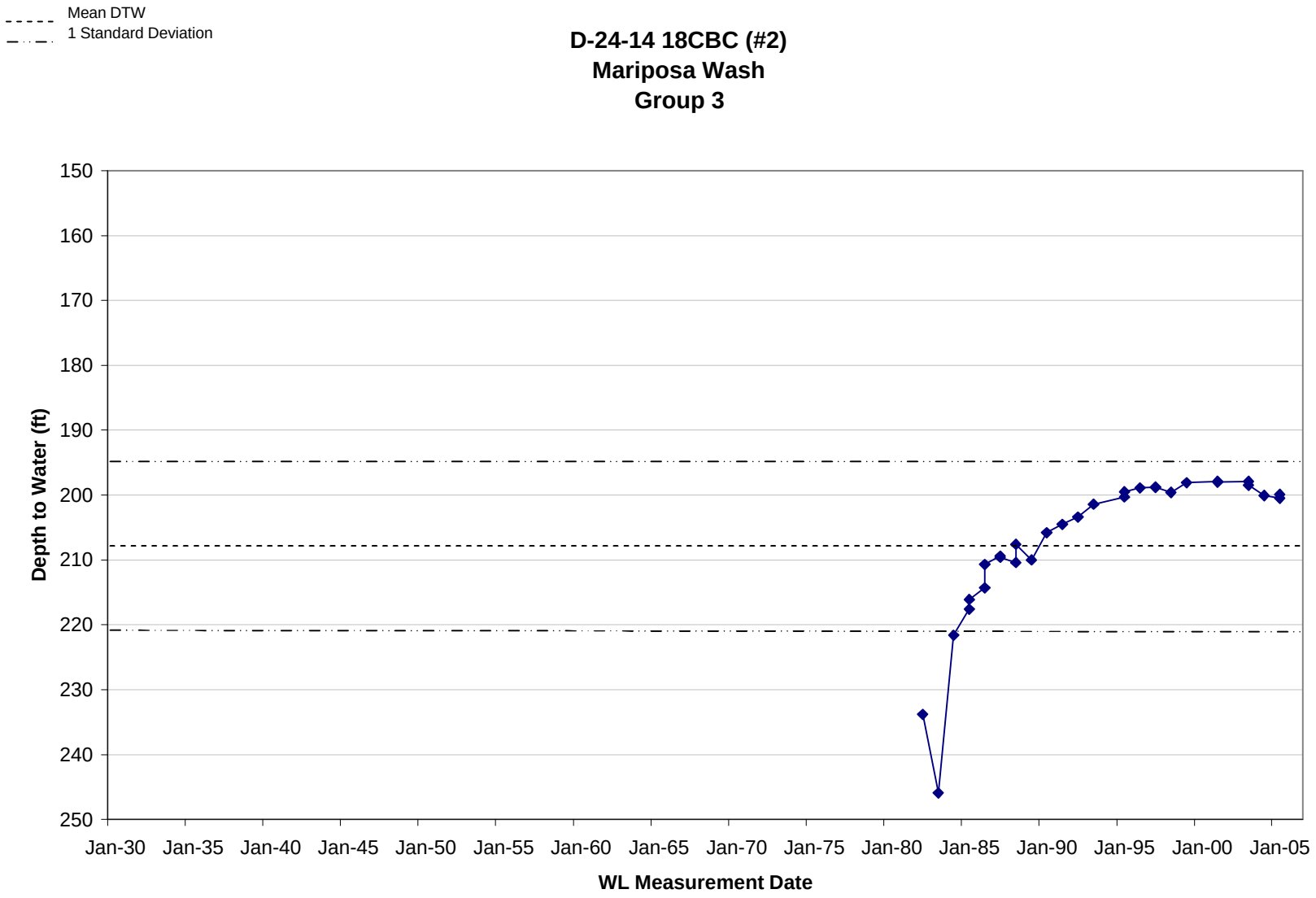


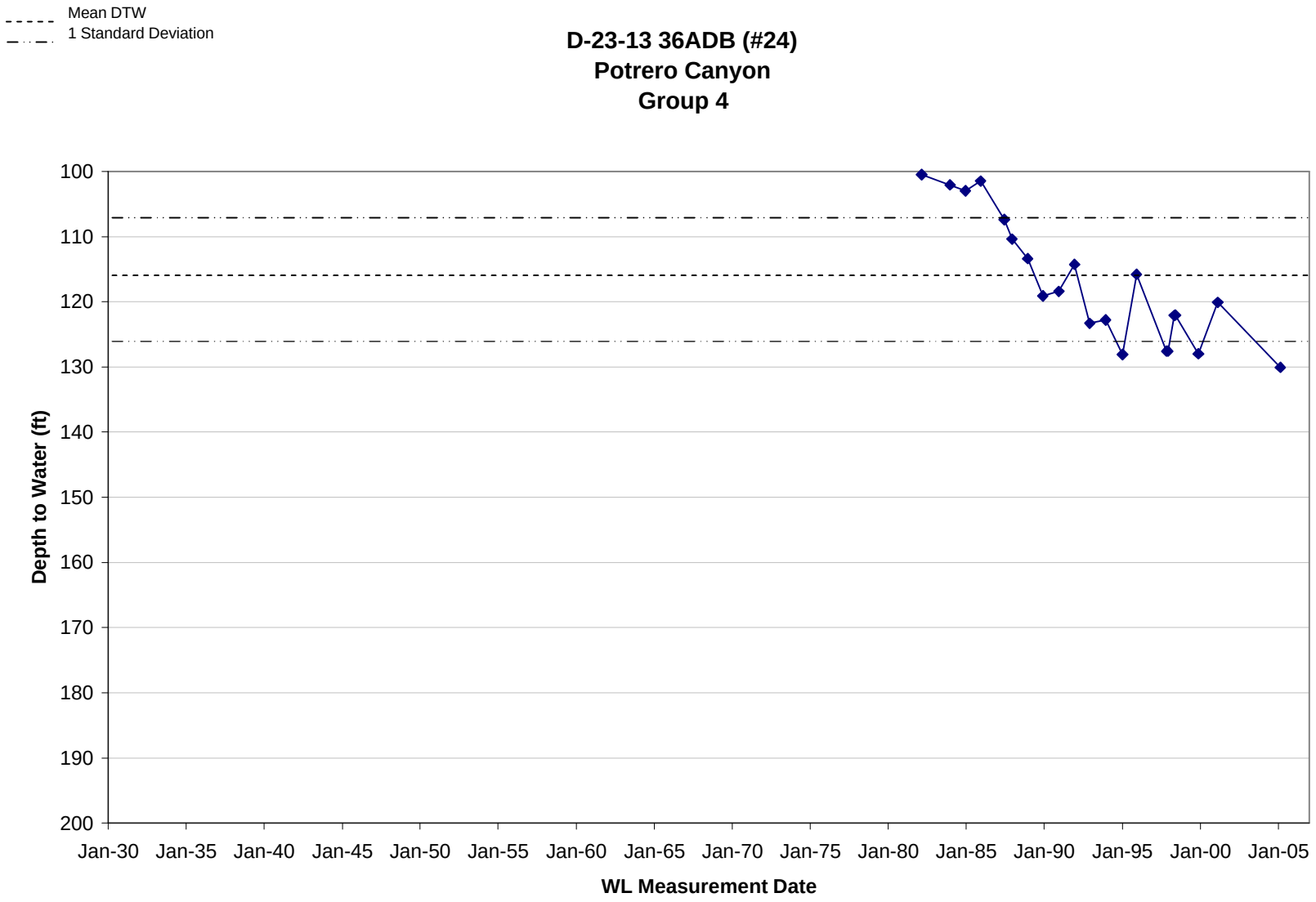
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Co unt	72	301	148	13	95	45	45	77	56	178	39	23
Percent	0.07	0.28	0.14	0.01	0.09	0.04	0.04	0.07	0.05	0.16	0.04	0.02

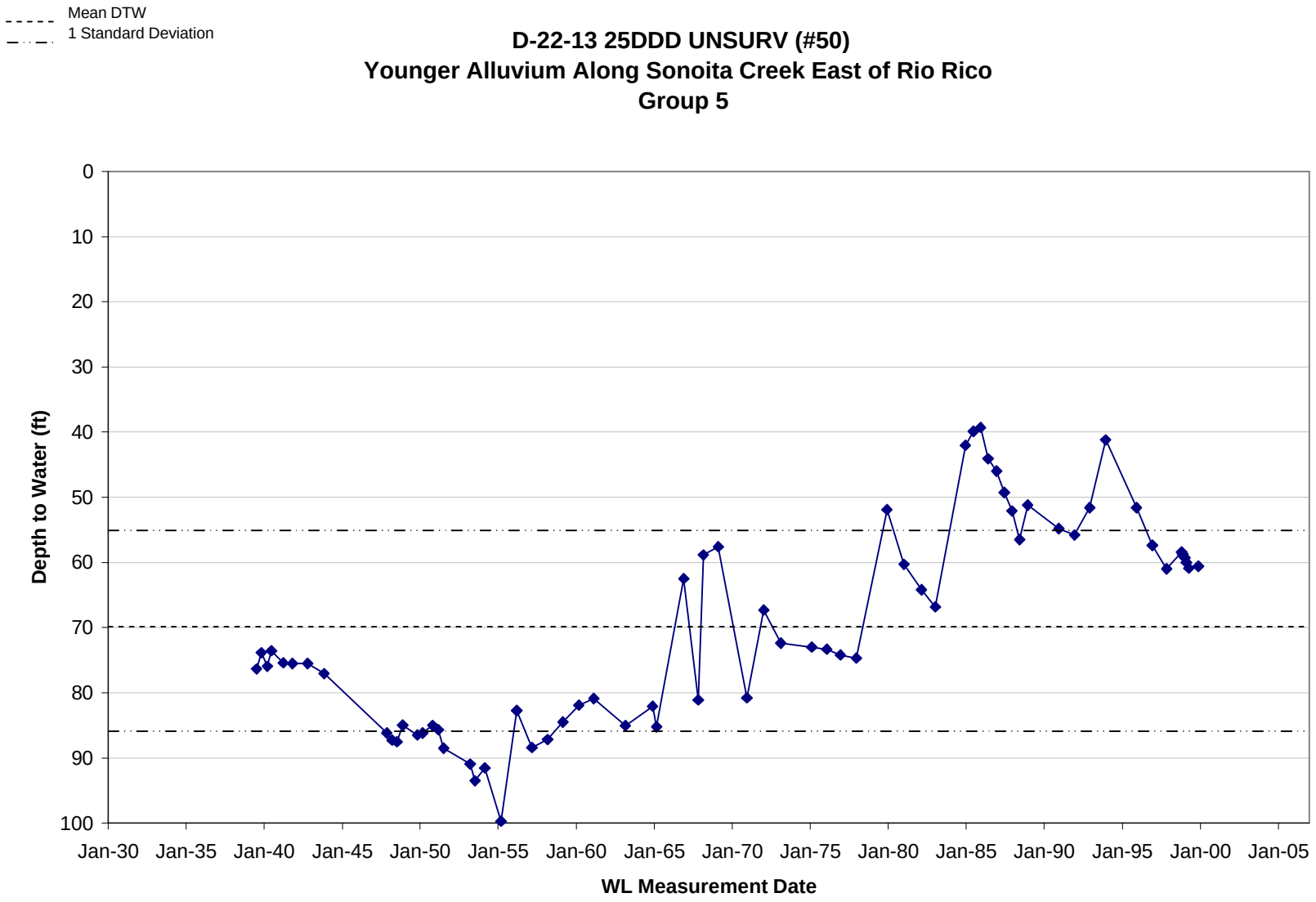
Appendix B – Hydrographs of Representative Wells in Well Grouping 1 through 13

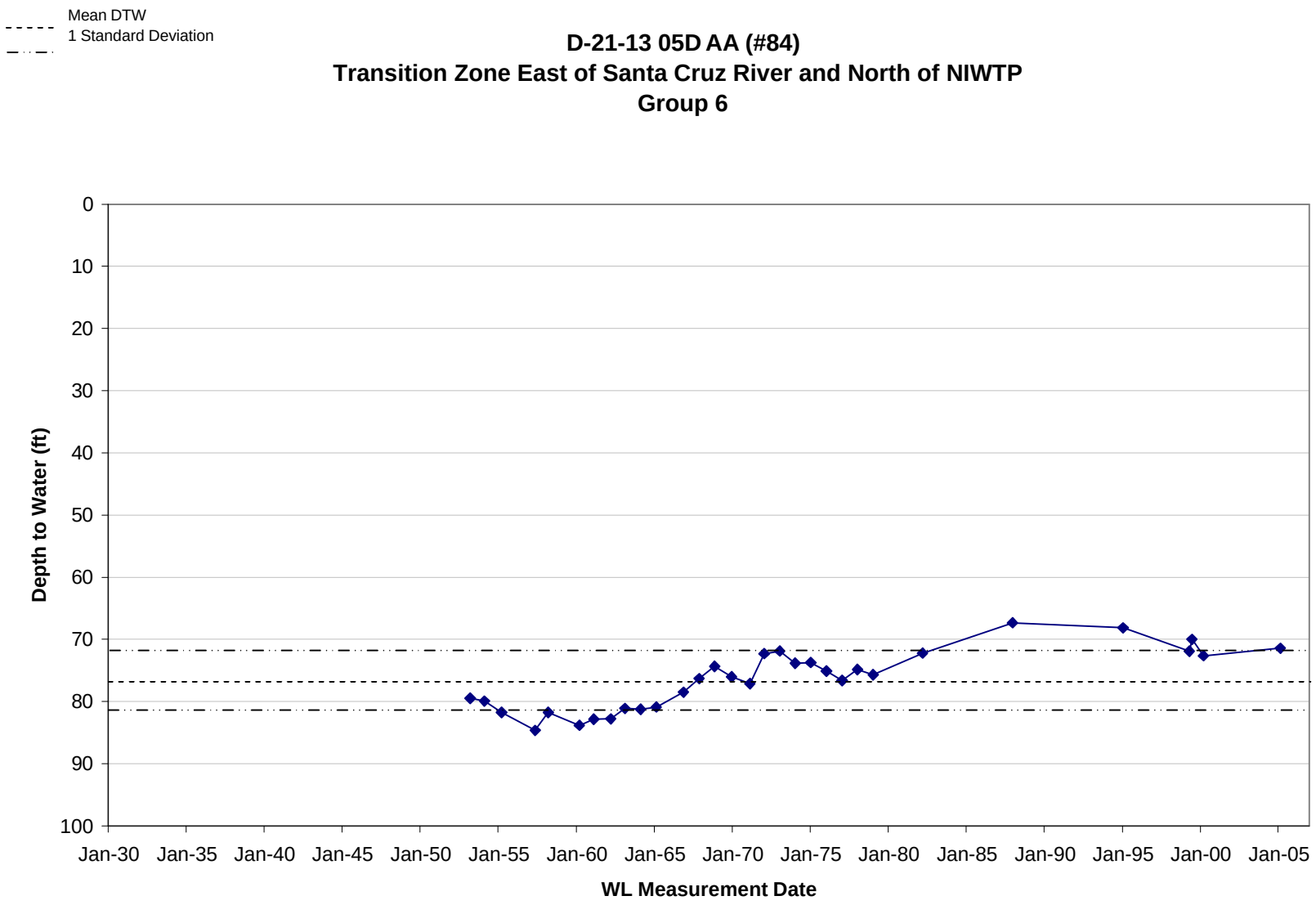

Mean DTW
1 Standard Deviation
D-20-11 02DAC (#112)
Older Alluvium North of Sopori Wash
Group 1
Depth to Water (ft)
100
110
120
130
140
150
160
170
180
190
200
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

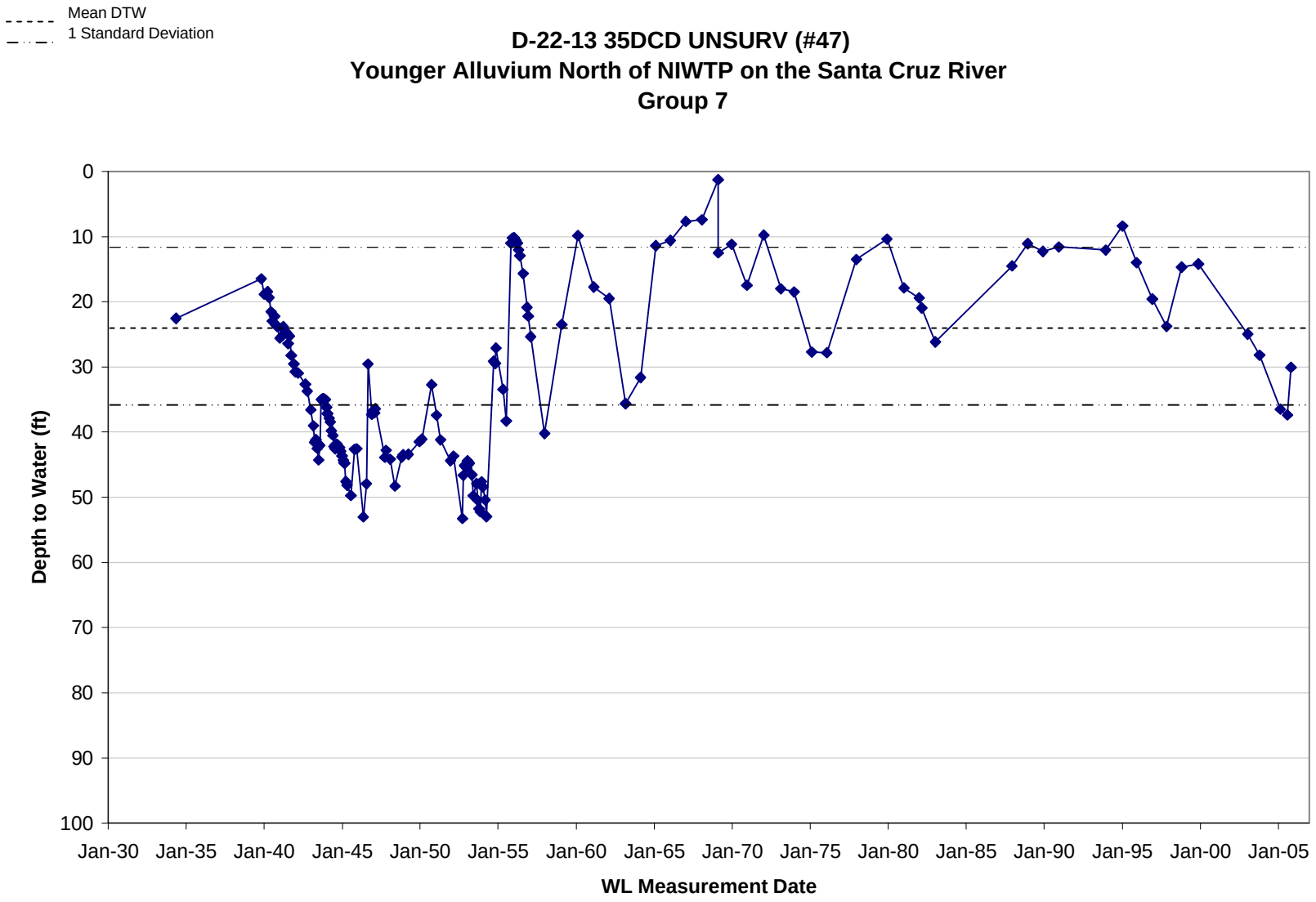

Mean DTW
1 Standard Deviation
D-24-15 04DDD1 (#9)
Older Alluvium East of Santa Cruz River and SE of NIWTP
Group 2
Depth to Water (ft)
20
30
40
50
60
70
80
90
100
110
120
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

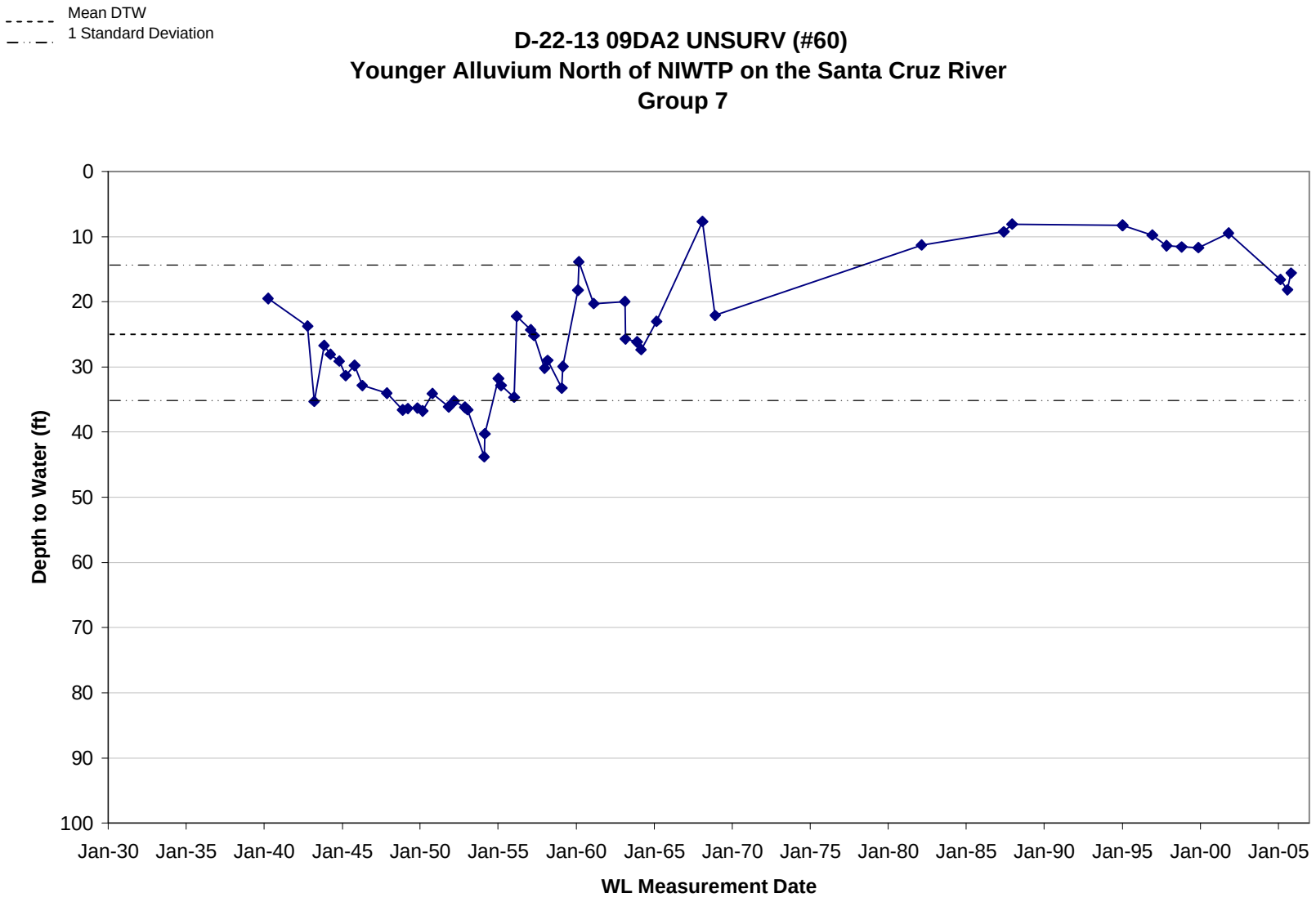

Mean DTW
1 Standard Deviation
D-24-14 18CBC (#2)
Mariposa Wash
Group 3
Depth to Water (ft)
150
160
170
180
190
200
210
220
230
240
250
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

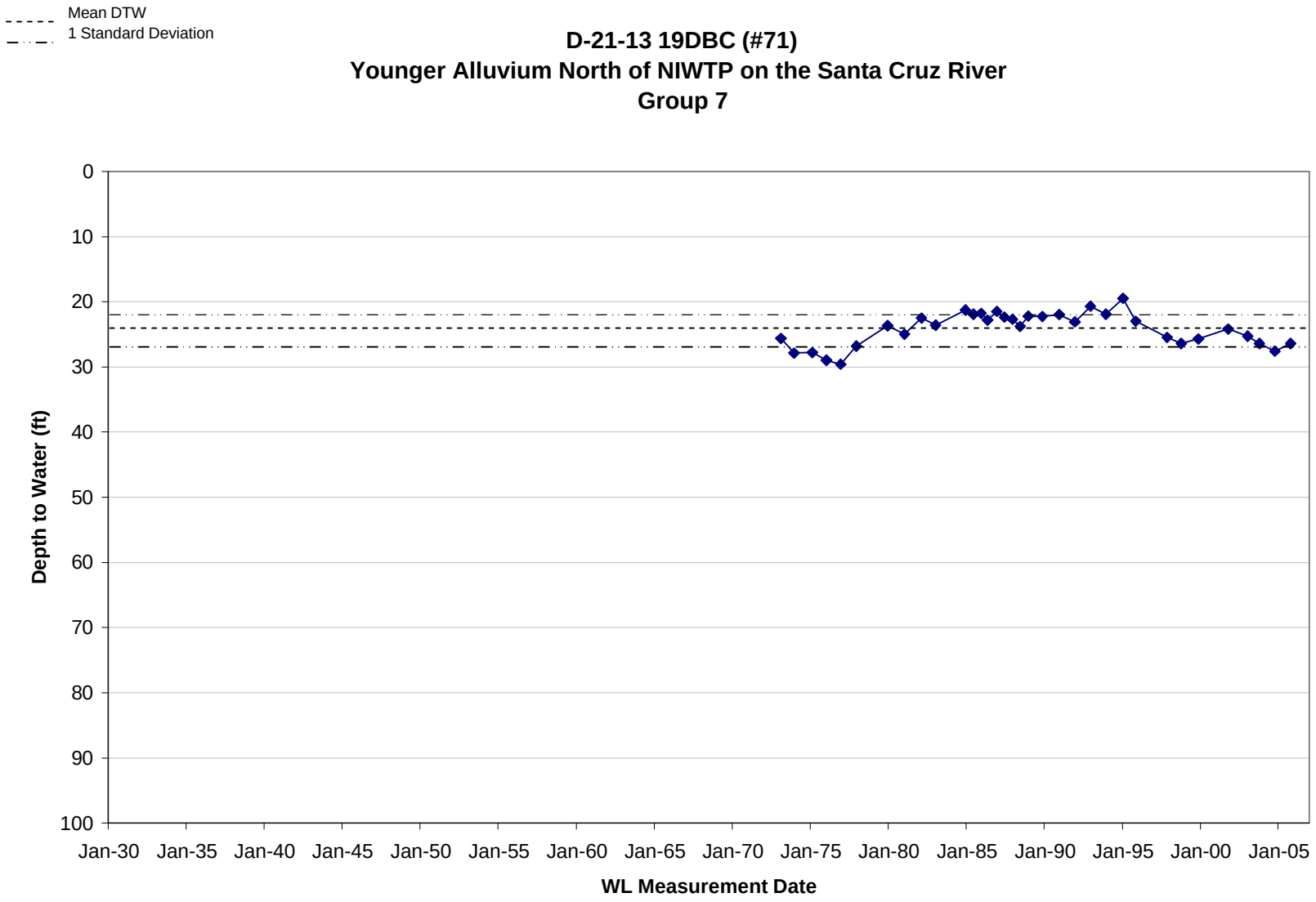

Mean DTW
1 Standard Deviation
D-23-13 36ADB (#24)
Potrero Canyon
Group 4
Depth to Water (ft)
100
110
120
130
140
150
160
170
180
190
200
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

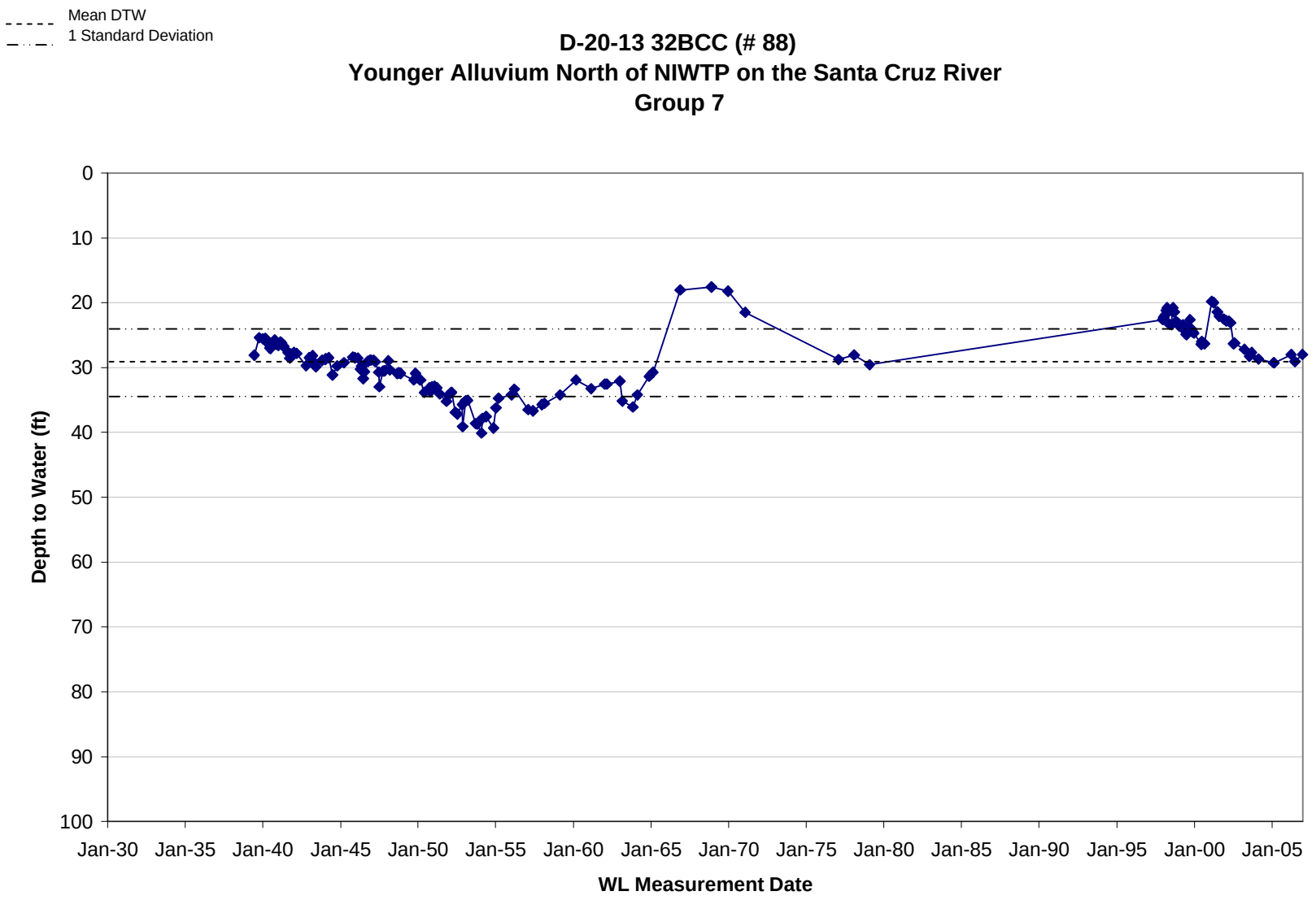

Mean DTW
1 Standard Deviation
D-22-13 25DDD UNSURV (#50)
Younger Alluvium Along Sonoita Creek East of Rio Rico
Group 5
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

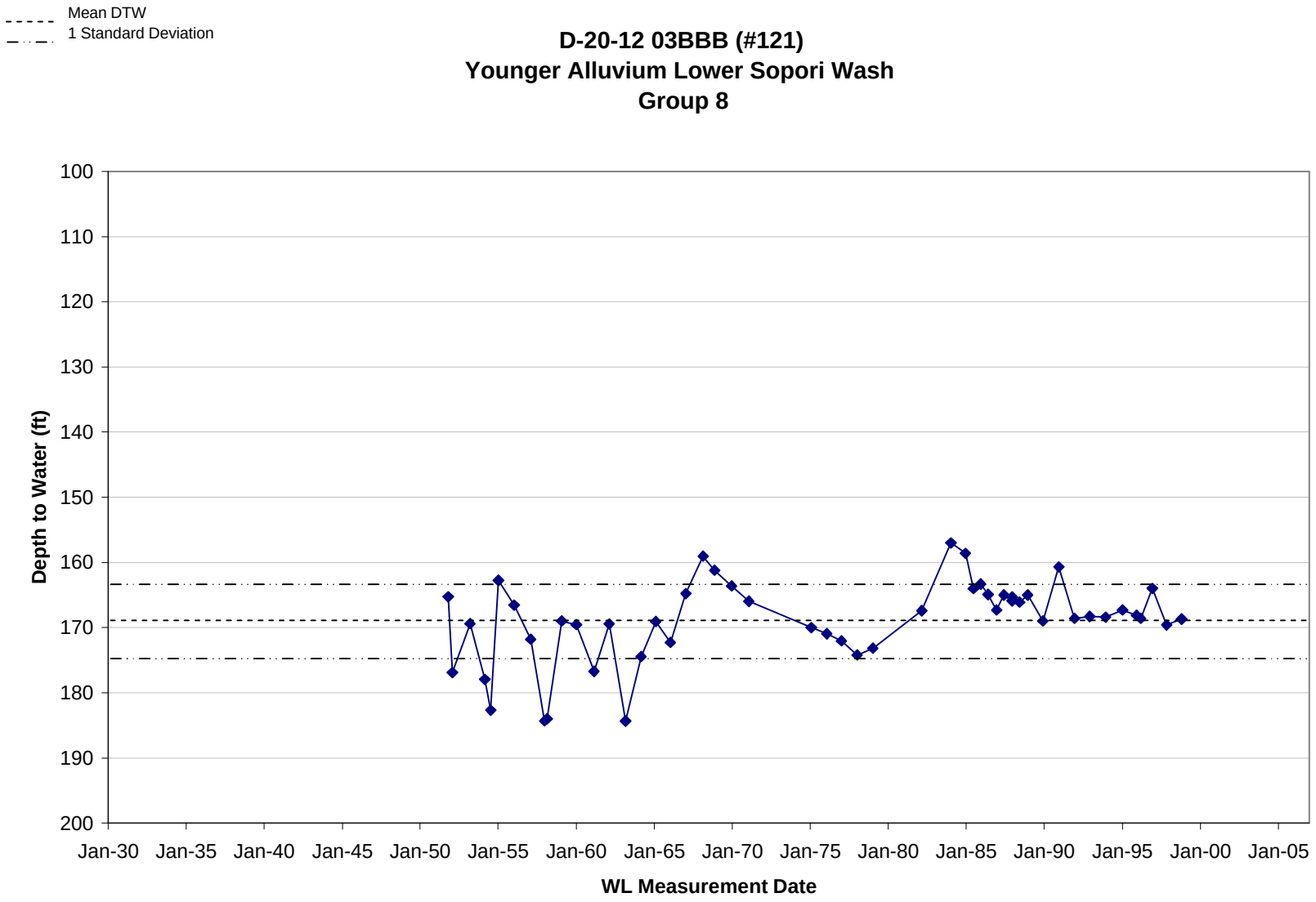

Mean DTW
1 Standard Deviation
D-21-13 05D AA (#84)
Transition Zone East of Santa Cruz River and North of NIWTP
Group 6
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

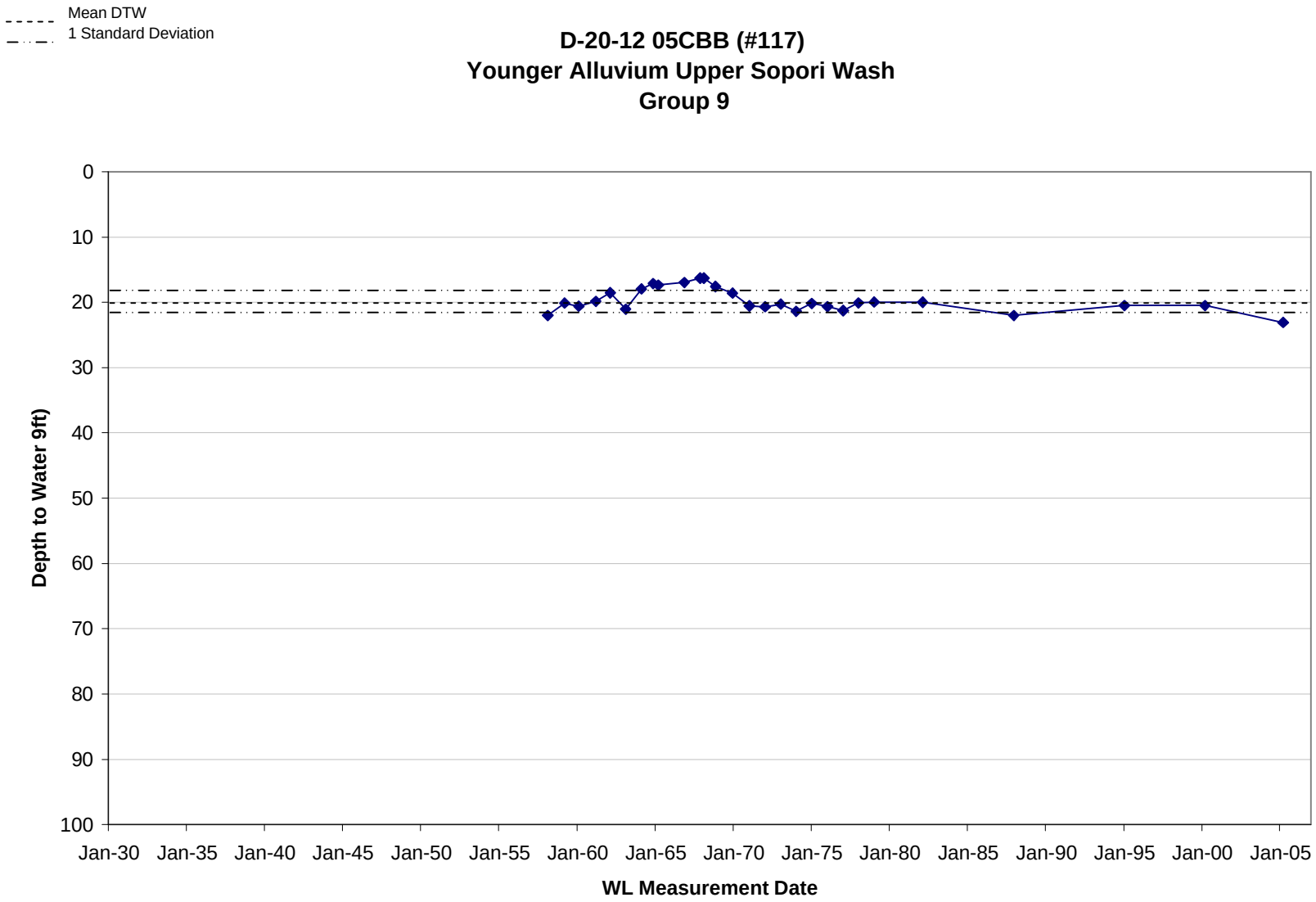

Mean DTW
1 Standard Deviation
D-22-13 35DCD UNSURV (#47)
Younger Alluvium North of NIWTP on the Santa Cruz River
Group 7
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

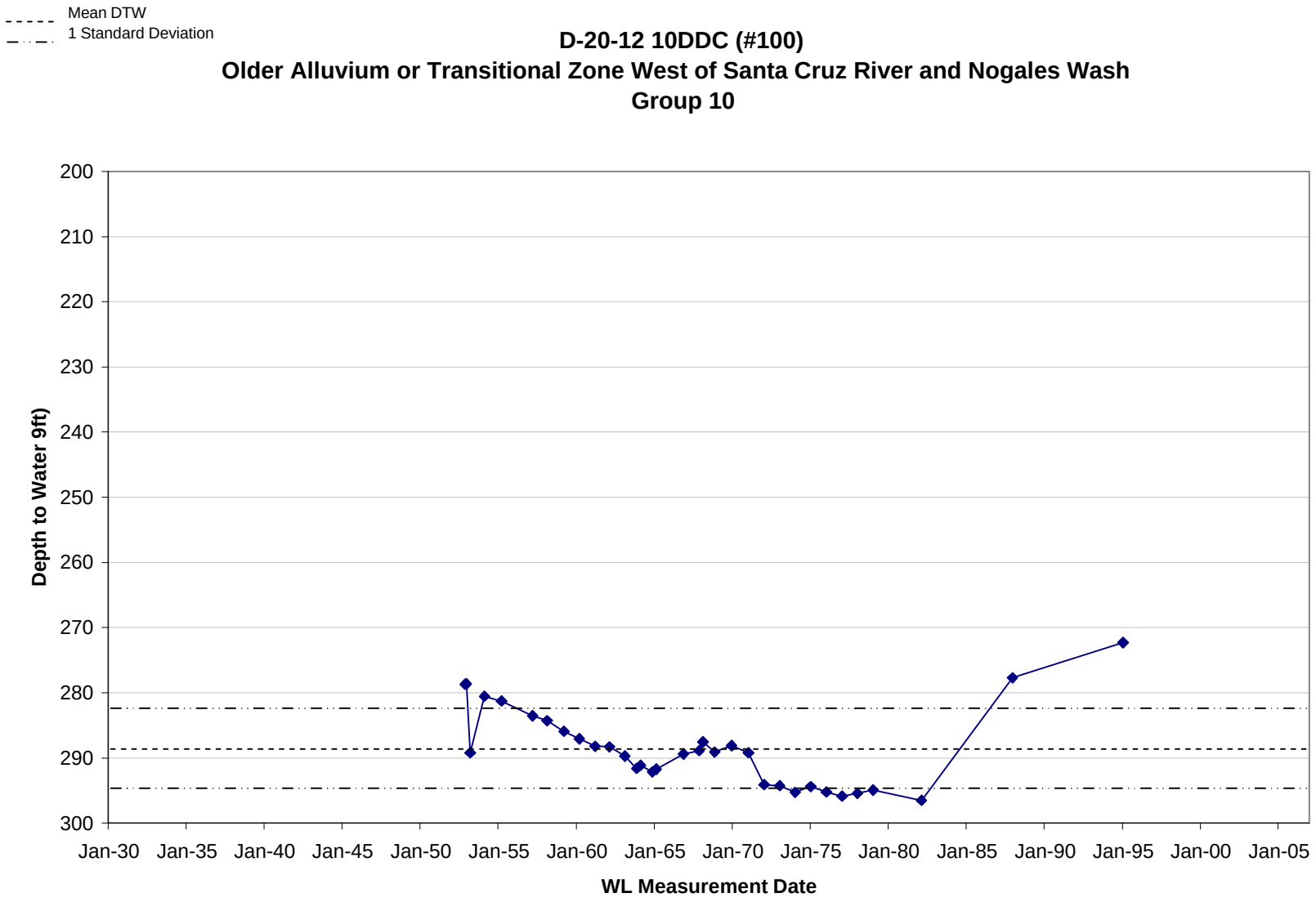

Mean DTW
1 Standard Deviation
D-22-13 09DA2 UNSURV (#60)
Younger Alluvium North of NIWTP on the Santa Cruz River
Group 7
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

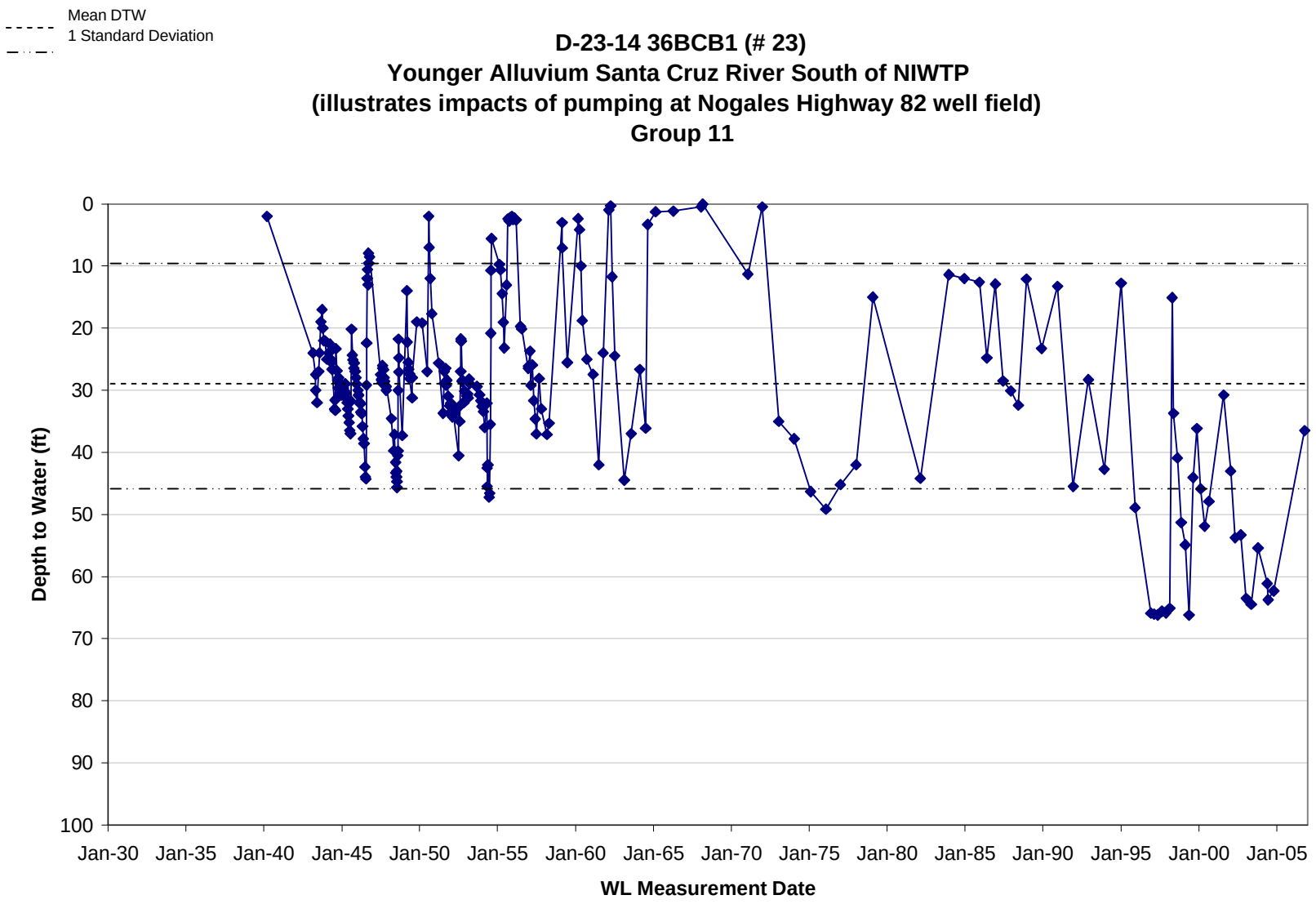

Mean DTW
1 Standard Deviation
D-21-13 19DBC (#71)
Younger Alluvium North of NIWTP on the Santa Cruz River
Group 7
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

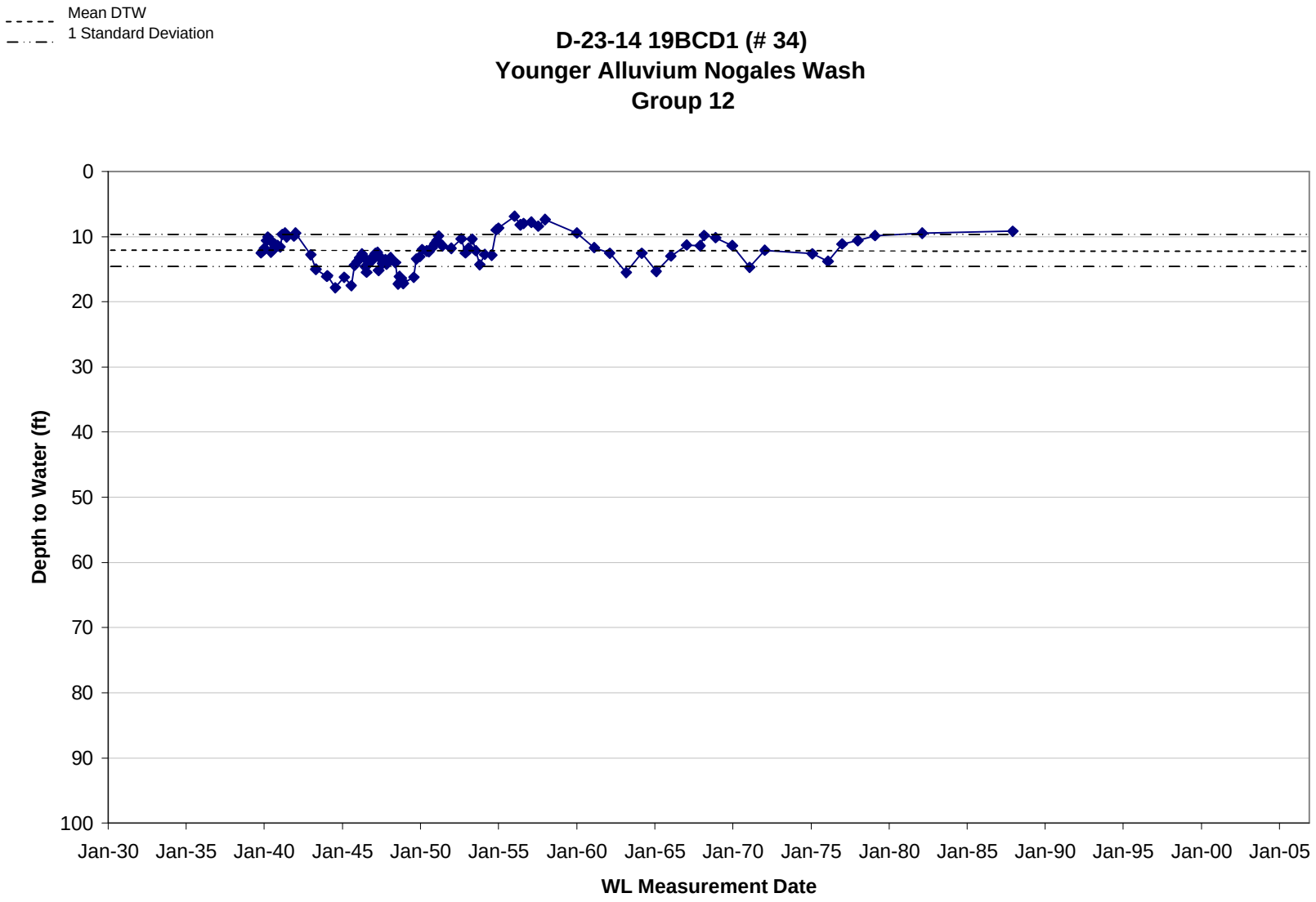

Mean DTW
1 Standard Deviation
D-20-13 32BCC (# 88)
Younger Alluvium North of NIWTP on the Santa Cruz River
Group 7
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date

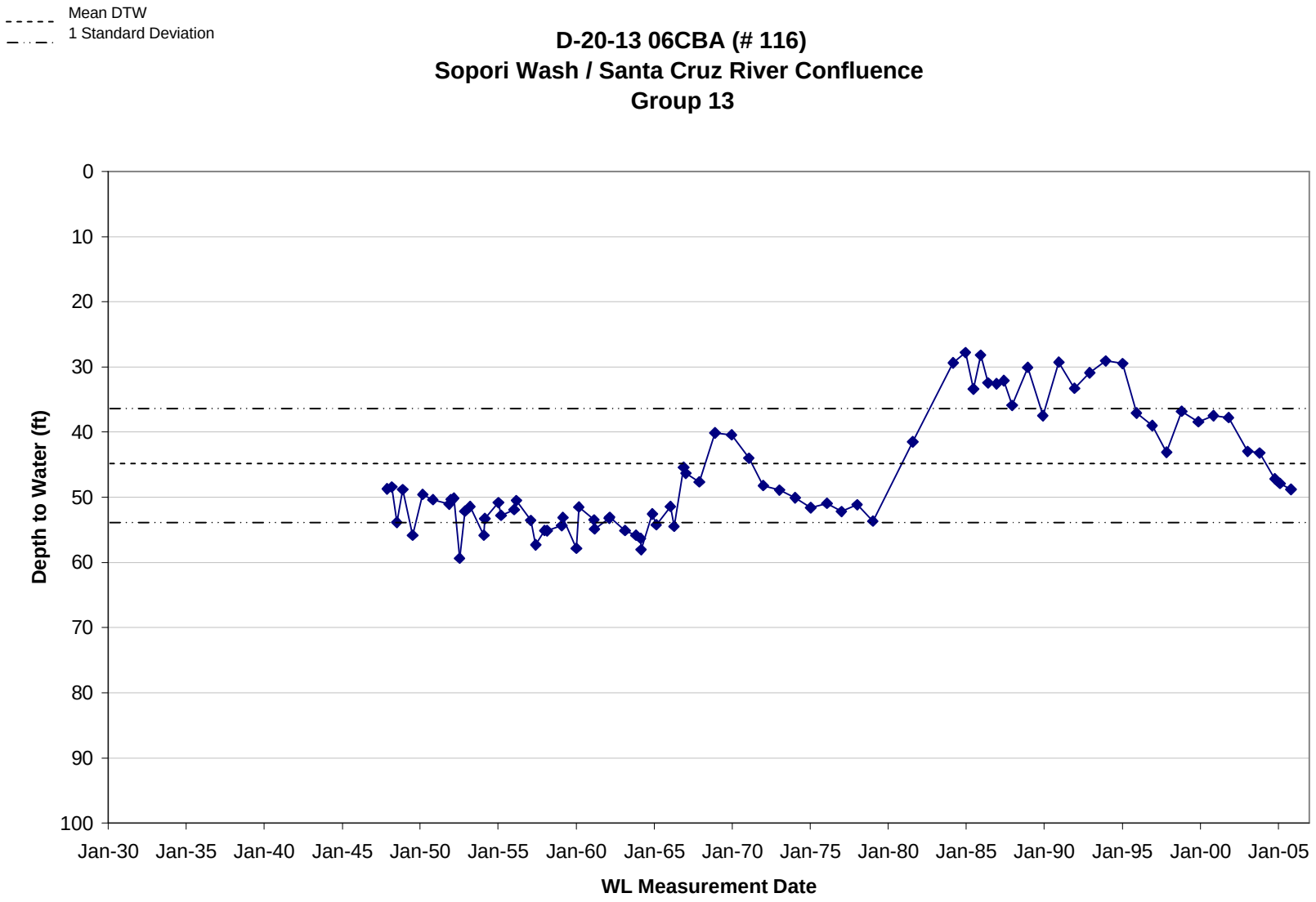

Mean DTW
1 Standard Deviation
D-20-12 03BBB (#121)
Younger Alluvium Lower Sopori Wash
Group 8
Depth to Water (ft)
100
110
120
130
140
150
160
170
180
190
200
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date


Mean DTW
1 Standard Deviation
D-20-12 05CBB (#117)
Younger Alluvium Upper Sopori Wash
Group 9
Depth to Water 9ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date


Mean DTW
1 Standard Deviation
D-20-12 10DDC (#100)
Older Alluvium or Transitional Zone West of Santa Cruz River and Nogales Wash
Group 10
Depth to Water 9ft)
200
210
220
230
240
250
260
270
280
290
300
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date


Mean DTW
1 Standard Deviation
D-23-14 36BCB1 (# 23)
Younger Alluvium Santa Cruz River South of NIWTP
(illustrates impacts of pumping at Nogales Highway 82 well field)
Group 11
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date


Mean DTW
1 Standard Deviation
D-23-14 19BCD1 (# 34)
Younger Alluvium Nogales Wash
Group 12
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date


Mean DTW
1 Standard Deviation
D-20-13 06CBA (# 116)
Sopori Wash / Santa Cruz River Confluence
Group 13
Depth to Water (ft)
0
10
20
30
40
50
60
70
80
90
100
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95
Jan-00
Jan-05
WL Measurement Date